U. S. DEPT. OF AGRICULTURE
FARM SECURITY ADMINISTRATION

FIELD HANDBOOK

(First Revision)

for

WISCONSIN FSA SUPERVISORS

Milwaukee, Wis.
January, 1944

FIELD HANDBOOK FOR WISCONSIN FSA SUPERVISORS

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In November of 1941, district and county supervisors in Wisconsin received the first copy of the "Field Reference Manual". In a great many counties, this handbook has been of a very distinct help in supervisory work. Because of certain trends due largely to the War, considerable information has changed with emphasis being placed upon other phases. Also new and more pertinent facts and information have been obtained. Accordingly, field revision No. 1 is herewith presented.

Every effort has been put forth to make this revised handbook meet the present day needs of FSA and Associate FSA Supervisors in their job of working with applicants and borrowers in developing farm plans. It should have still greater significance in extending more and better supervision in the future since the present and immediate objective is "Increased Food Production".

This handbook, if it is to have any real value, must be carried by county supervisors at all times when making farm visits. It contains considerable technical information, as well as practical, that can be referred to at frequent intervals. This should overcome many so-called technical questions that are so prevalent in the field. This makes it very valuable for actual field work. However, it should be kept in mind that this is only a handbook. If more detailed information is desired, the supervisors should refer to the county office bulletin library which has now been set up by the administrative supervisors, or will be in the very near future.

Much of the material in this handbook was gathered and condensed from various Wisconsin College of Agriculture and State Department of Agriculture publications. Members of the Wisconsin College of Agriculture staff and Extension Division have given valuable assistance in the preparation and editing of the material contained in the handbook. These contributions are greatly appreciated. Many valuable suggestions were also received from county, district, state, and regional FSA personnel.

SECTION I - COUNTY OFFICE BULLETIN LIBRARY

USE OF COUNTY OFFICE BULLETIN LIBRARY

On the following pages is a list of bulletins that have been designated as official FSA bulletins which are to be filed in the county office bulletin library. The Administrative Supervisors have been assigned the job of classifying, indexing, and filing the bulletins that have been designated for official use.

New bulletins will be added to the official list from time to time, while some may be deleted. All new bulletins will be checked and reviewed in the regional office to determine if they are of sufficient value to be added to the official list. If they do contain valuable information, steps will be taken to obtain such bulletins from the college and have them forwarded to the respective county offices. At the same time, administrative supervisors will receive notification of newly accepted bulletins being sent to the field so that they may be properly classified and filed.

Special emphasis is being placed on the fact that these bulletins should not be removed from the county office library. They are for use of the county office only. It is mainly for that reason that Field Handbooks have been developed for county supervisory personnel. This handbook contains pertinent facts pertaining to the field, that has been condensed from selected bulletins and other publications.

In the event borrower families desire bulletins or circulars of any kind for private use, they should be advised to contact their County Agent's office. Every means possible should be used to encourage borrower families to utilize the educational facilities of the Extension Division.

WISCONSIN BULLETIN FILE BREAKDOWN

COOPERATIVES

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FARM HOUSING

(The Wisconsin Straw Loft Poultry House -- No. 284
(The Wisconsin 2-Story Poultry House -- No. 292
(Milk Houses for Wisconsin -- No. 312 (Rev.)
(Sewage Treatment & Disposal for Farm Homes -- No. 309
(Housing Farm Machinery -- No. 283
(Steps to Good Milk & Cream -- No. 295
(The Manure Heated Hotbed -- No. 51 (Rev.)
(Colony Hog Houses for Wisconsin -- No. 225
(Self Feeders Cut Costs of Pork Production -- No. 227
(Colony Houses for Poultry -- No. 208 (Rev.)
(Silos -- No. 230
(Wiring the Farmstead for Electricity

FIELD CROPS

General

(Some Farm Weeds -- No. 171
(Bordeaux Mixture -- No. 234

Corn

(Hybrid Corn in Wisconsin -- No. 291
(Corn Growing
(Good Corn Silage -- No. 337
(Fight the European Corn Borer Now

Forage Crops & Pasture

(Renovating Blue Grass Pastures -- No. 277
(Safeguard the New Seedings -- No. 300
(Inoculate Legumes -- No. 252
(Grass Silage -- No. 299
(Put Pastures to Work -- No. 330
(Reed Canary Grass for Wisconsin Lowlands -- No. 264

Grain

(Quality Barley -- No. 278
(Winter Rye - Growing and Feeding -- No. 301
(Grain Seed Treatment -- No. 128 (Rev.)
(Sow Winter Grain -- No. 338

Potatoes

(Potato Growing in Wisconsin

Special Crops

(Rotation and the Tobacco Crop -- No. 412
(Canning Peas in Wisconsin -- No. 444
(Tobacco Varieties & Strains in Wisconsin -- No. 448
(Tobacco Mosaic and Its Control -- No. 445
(Root Crops Are Profitable -- No. 330 (Reprint)
(Succulent Feed Crops -- No. 436
(Sugar Beets in Wisconsin (Farm Costs & Production Practices)
(Navy Beans

FORESTRY AND LAND UTILIZATION	(Woodland Improvement -- No. 305 (Rev.) (The Farm Windbreak -- No. 267 (Rev.) (Shelterbelts for Windblown Soils -- No. 287 (Reforestation by Private Enterprise -- No. 239 (Restoring Northern Forests -- No. 321
FRUITS & VEGETABLES	
Fruits	(Farm Orchards -- No. 265 (Rev.) (Growing Raspberries and Blackberries -- No. 280 (Rev.) (Strawberry Growing in Wisconsin -- No. 268 (Rev.) (The Home Vineyard -- No. 186 (Rev.)
Vegetables	(A Home Garden on Every Farm -- No. 329
LIVESTOCK	
Cattle	(Bang's Disease - Its Control & Eradication -- No. 260 (Rev. (Raising Dairy Calves -- No. 308
Cattle - Feeding	(Feed Grinding -- No. 286 (Minerals for Livestock -- No. 297 (Feeding Dairy Cows
Hogs	(Anemia in Suckling Pigs -- No. 409 (The Brood Sow and Litter -- No. 307 (Self Feeders Cut Costs of Pork Production -- No. 227 (See (Hog Feeder -- No. 339 "Housing") (Whey for Livestock -- No. 340
Horses	(Take Care of the Work Horse (Rev.)
Poultry	(Tuberculosis in Poultry -- No. 210 (1st Rev.) (Feeding for Eggs -- No. 141 (6th Rev.) (Chick Brooding -- No. 285 (Care and Feed of Baby Chicks (Raising Turkeys in Wisconsin -- No. 231 (Emergency Rations for Chicks (A Family-sized Poultry Flock
Sheep	(Better Sheep Management -- No. 270
MACHINERY	(((
MANAGEMENT & ECONOMICS	(What Does Northern Wisconsin Farming Need Most? (Selecting a Farm in Northern Wisconsin (The Life Cycle of the Farm Family -- No. 121 (Wisconsin Farm Prices 1841-1933 -- No. 119 (Forces Affecting Wis. Agriculture with Resulting Types of (Farming -- No. 131 (Farm Family Living in Wisconsin -- No. 114 (How Farm Families Meet the Emergency -- No. 126 (Man Land Adjustment -- No. 134

MISCELLANEOUS	(Conducting the Business Meeting -- No. 227
	(Blasting with Safety -- No. 288
	(What's New in Farm Science -- No. 456
	(What's New in Farm Science -- No. 460
	(A Homemade Garden Wheel Hoe
SOIL CONSERVATION	(Cropping Systems That Help Control Erosion -- No. 452
	(Strip Cropping to Control Erosion -- No. 317
	(Grass Waterways Control and Prevent Gullies -- No. 320
	(Does Soil Conservation Pay? -- No. 459
SOILS AND FERTILIZERS	(Soil and Crop Practices in Wisconsin
	(Save Plant Food in Manure -- No. 296
	(How to Manage Sandy Soil
	(Fertilizers for Tobacco -- No. 413
	(Soil Erosion -- No. 311
	(Liming Wisconsin Soils
	(What Fertilizers for Lawns & Gardens -- No. 92 (Rev.)
	(Better Yields on Central Wisconsin Soils
	(Farming Peat Lands in Wisconsin (Rev.)
TENURE	(
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SECTION II - TENURE

LEASE ARRANGEMENTS

A lease is legally an enforceable contract but ordinarily it works out to be a memorandum of understanding between owner and tenant. Most misunderstandings between the two parties are ordinarily about small items--much too small to warrant settling in court. Leases should be written clearly and simply and every important point, talked over by owner and tenant, should be covered. A lease arrangement should guard against the obligations of partnership, wherein each of the partners is responsible for the other's obligations no matter how incurred. For this reason it is desirable to have some phrase such as "This is not a partnership" written into every lease form.

Lease Must Contain Faith of Both Parties

Certainly the real purpose of a written lease, whether for one year or for five, is to confirm a meeting of minds between the tenant and the landlord on the farm plan and the responsibilities and privileges of each of the parties. The FSA supervisor can provide a valuable service as a third party when the lease is drawn up. He should act in the capacity of a referee to see that all terms are fair and equitable. As soon as the terms indicate an impartial attitude toward either party, mutual relations have been broken. If the supervisor acts as a third party in drawing up such an agreement, he can follow through with the tenant to see that, insofar as possible, the tenant's part of the bargain is carried out.

A one-year lease (with provision for automatic renewal) which confirms a meeting of minds between the landlord and the tenant on a sound and fair farm plan, accompanied by definite performance by both parties, spells improved tenure. Certainly the formal provisions of the lease are of small significance unless backed by the good faith and will to perform by both tenant and landlord.

Seven Important Objectives for All Leases

1. To make use of the compensation principle for making of improvements.

2. To make provisions for soil conservation in the improvement practices and to provide for compliance with the current crop control program of the Department of Agriculture, unless the rehabilitation of the family will suffer thereby.

3. To provide repairs and improvements so that the minimum housing standards will be available to the family.

4. To provide for woodland management which will bring income to both the landlord and the tenant.

5. To provide for security of tenure in order to carry out the several objectives.

6. To provide for an understanding regarding proper financing to implement the improvements in tenure relationships.

7. To make maximum provision for a self-sufficiency program.

LEASE REVIEW SHEET

A. Mechanical Lease Provisions:

1. Is lease written?
2. Is lease on an acceptable form?
3. Is lease dated?
4. Does it provide for a beginning and expiration date?
5. Does it include correct legal description of all portions of the farm to be leased?
6. Is it legally signed and witnessed?

B. Lease Objectives:

1. Is compensation principle utilized for making necessary improvements such as:

   a. Building and fence repairs, additions, and new construction?

   b. Soil improvement through:

      (1) Addition of lime?
      (2) Addition of commercial fertilizer?
      (3) Plowing down green crop?
      (4) Furnishing seed for soil building crops?

   c. Is adequate compensation provided at termination of lease for unused portion of improvements made by tenant?

2. Is provision made for soil conservation in compliance with current crop control programs--U.S.D.A.?

3. Are necessary repairs and improvements provided for so that minimum housing standards will be available to the family?

4. Is woodland management planned for which will bring income in the form of cash, fuel, or materials to both tenant and landlord?

5. Is security of tenure assured through long-term lease?

6. Is understanding regarding financing improvements which are needed, and landlord is not in a position to make, clearly stated and adequate?

7. Is maximum provision made for a self-sufficiency program?

C. Type of Rent:

1. Is the type of rent provided for in the lease (crop share, stock share, cash, or a combination) most suitable under the conditions existing in this case?

D. Amount of Rent and Time of Payment:

1. Is amount of rent within the rent-paying capacity of this farm and operator, as determined by a sound farm and home plan?

2. Does rent provide for a fair division of income between landlord and operator, as determined by a sound farm and home plan?

3. Is method of dividing items in share rent lease stipulated?

4. Is time of making rental payments best suited to type of farming followed?

E. Renewal and Cancellation Clauses:

1. Does lease include automatic renewal clause, effective 6 months prior to lease expiration?

2. In case of sale clause, does lease provide for at least 3 to 5 months' notice to tenant, or privilege of staying to end of crop season, whichever is longer?

3. Is ample compensation provided to reimburse tenant for costs and loss incurred in case farm is sold before termination of lease?

4. Is there fair provision for cancellation of lease in case either party violates important lease provisions?

F. Lease and Plan Coordination:

1. Does the lease include provisions necessary to enable tenant to operate with a sound farm and home plan?

2. Do farm and home plan and the lease agree on items covered in both?

3. Was farm and home plan used as a basis for determining rental rather than being built around predetermined rental arbitrarily set?

4. Was lease developed jointly by landlord, tenant and wife, and FSA representative?

G. Other Considerations:

1. Does lease definitely stipulate:

a. Items and funds landlord is to furnish?
b. Items and funds tenant is to furnish?
c. Date items are to be provided?
d. Date work is to be completed and compensation made?

2. Is security for payment of rent stipulated in lease fair and reasonable?

3. Does lease include adequate and fair arbitration clause in case of disagreement between tenant and landlord?

H. Has there been genuine, efficient attempt to incorporate practices in the lease that are mutually beneficial to both tenant and landlord?

LAND PURCHASE CONTRACTS AND REAL ESTATE MORTGAGE ANALYSIS SHEET

A. Mechanical Provisions:

1. Does instrument include correct legal description of all portions of the farm?

2. Has instrument been properly executed and recorded?

3. Has instrument been reviewed by a competent attorney?

B. Title - Liens on Vendor's Equity:

1. Was buyer furnished with up-to-date abstract, indicating that the vendor has satisfactory title?

2. Was abstract reviewed by a competent attorney?

3. Does contract state amount of vendor's mortgage, if any?

4. Was buyer accurately informed regarding taxes and special assessments outstanding against the property?

5. Does the contract provide for a vendor to convey title and the purchaser assume the vendor's mortgage when contract amount has been reduced to amount of the mortgage?

C. Purchase Price:

1. Is purchase price within the amount that has been or would be set by an accurate earning capacity appraisal?

2. Can the improvements which are necessary on this unit be provided by the operator after meeting other contemplated expenses?

D. Payments Specified:

1. Period

   a. Is sufficient time given during which buyer can entirely retire the obligation?

   b. If period is not adequate to permit "a" above, is sufficient time given so that buyer can establish sufficient equity to obtain refinancing on reasonable terms elsewhere?

2. Amount

   a. Are annual payments based on earning capacity of the farm, taking into consideration other necessary costs?

   b. Are interest charges, taxes and normal real estate upkeep (not including principal payments) within usual landlord's share of this farm?

c. Is interest rate reasonable?

d. Is provision made for variable payments to protect buyer in lean years?

e. Is provision made for reduced payments in years when buyer must finance stipulated improvements?

E. Time of Obtaining Deed:

1. Does contract provide for delivery of deed to buyer by the time principal payments or improvements reach 25% of the purchase price?

F. Compensation Clause in Case of Contract Termination:

1. Does instrument provide for compensation to the buyer by the seller in an amount equal to the residual value of improvements mutually agreed upon in case contract is terminated?

2. Does contract provide for return of a satisfactory per cent (50) of principal payments to buyer in case contract is terminated for any reason?

G. Seller Restrictions:

1. Are the restrictions in the contract fair and reasonable?

2. Are the restrictions such that they will not interfere with or hamper the buyer in adopting and executing sound farm and home plans?

H. Does the contract indicate the seller's real desire to have farm "Remain Sold" to this buyer?

SECTION III - SOILS AND FERTILIZERS

It is the business of the farmer to sell plant food from the farm in the form of cash crops, dairy products, livestock and by-products. Every bushel of produce, every ton of hay or straw, every pound of milk, butter, beef, pork, veal, poultry or eggs SOLD OFF THE FARM takes with it a certain amount of plant food and it all comes directly or indirectly from the soil.

These losses can be partly offset by the buying back of concentrates, the raising of legumes and the careful conservation and return to the land of all manure produced on the farm. However, there are but few farms where the losses are entirely offset by these practices and it, therefore, becomes necessary to buy back some commercial fertilizer in order to keep our land in a balanced state of fertility. The pounds of nitrogen, phosphoric acid, potash and lime removed by crops per acre each year are noted in the following table. It should be noted that the amounts of lime and potash removed by the grain and straw of cereals represents only a portion of that amount required by these crops, for in maturing these crops lose through leaching a certain amount of lime and potash. Note the difference in the amounts of lime and potash removed by oat hay and the matured crop of oats and straw. It should also be observed that lime is leached out of the soil at rates of from 300 to 500 pounds per acre per year where large amounts are present.

Crops	Yield per acre	Nitrogen N	Phosphoric Acid P_2O_5	Potash K_2O	Lime as $CaCO_3$
Alfalfa hay	4 tons	190 lbs.	43 lbs.	178 lbs.	340 lbs.
Clover hay (med.)	2½ "	103 "	20 "	82 "	188 "
Soy bean hay	3 "	154 "	41 "	140 "	270 "
Oat hay	2 "	53 "	32 "	131 "	40 "
Millet hay	3 "	80 "	33 "	152 "	40 "
Timothy hay	2 "	49 "	16 "	68 "	40 "
Corn (on cob)	75 bu.	68 "	29 "	16 "	1.5"
Corn fodder	3 tons	57 "	27 "	77 "	52 "
Corn silage	12 "	80 "	38.4"	105 "	35 "
Barley (grain)	40 bu.	35 "	16 "	14 "	2 "
Barley (straw)	1½ tons	12 "	5 "	30 "	15 "
Oats (grain)	60 bu.	40 "	16 "	11 "	3 "
Oats (Straw)	1½ tons	17 "	6 "	45 "	20 "
Rye (grain)	25 bu.	26 "	10 "	8 "	1.1"
Rye (straw)	1½ tons	12 "	7 "	20 "	15 "
Wheat (grain)	30 bu.	35 "	15 "	9 "	2 "
Wheat (straw)	1½ tons	15 "	4 "	22 "	10 "
Peas (dried)	20 bu.	44 "	10 "	14 "	6 "
Peas (straw)	1½ tons	29 "	5.5"	37 "	105 "
Buckwheat (grain)	30 bu.	21 "	12 "	10 "	3/4 "
Buckwheat (straw)	1 ton	16 "	3 "	23 "	34 "
Flax (grain)	15 bu.	29 "	12 "	9 "	5 "
Flax (straw)	1 ton	20 "	9 "	28 "	26 "
Soy beans (grain)	20 bu.	67 "	15.6"	34 "	5.5"
Soy beans (straw)	1 ton	34 "	12 "	46 "	78 "
Tobacco (leaves)	1500 lbs.	40 "	5.9"	82.6"	102.5"
Tobacco (stems)	1250 "	25 "	5.5"	46 "	17 "
Cabbage (heads)	12 tons	72 "	26 "	104 "	70 "
Onions	600 bu.	92 "	45 "	87 "	90 "
Potatoes	250 "	52 "	18 "	80 "	7.5"
Sugar beets	15 tons	76 "	23 "	111 "	20 "
Turnips	800 bu.	79 "	29 "	127 "	60 "
Hemp (dry stalks)	3 tons	20 "	8.8"	61 "	75 "

Animal, produce, by-product, etc.	Weight	Nitrogen	Phosphoric Acid P_2O_5	Potash K_2O	Lime as CaO
Fat calf	1000 lbs	24.6 lbs.	15.3	2	16.4
Fat steer	1000	25.2	15.5	1.7	17.9
Fat lamb	1000	19.7	11.2	1.6	12.8
Fat sheep	1000	19.7	10.4	1.5	11.8
Fat pig	1000	17.6	6.5	1.4	6.3
Wool (unwashed)	1000	54.0	0.7	56.2	1.8
Milk	1000	5.7	2.0	1.7	1.7
Butter	1000	1.2	0.4	0.4	
Hens eggs	1000	20.0	4.2	1.7	60.8

Plant Food Recovered in Manures, Fertilizers and Concentrates

Note: It should be observed that from 40 to 60% of the nitrogen and from 70 to 80% of the potash and practically none of the phosphoric acid is contained in the liquid portion of the manure. Nearly 70% of the fertilizing constituents of feeding stuffs is recovered in manure. The composition of manure varies greatly, depending on the kind of animal, quality and quantity of feed, the age of animal and bedding use. The average composition for different manures is given below. (From Thorne's Farm Manures.)

Average Composition of Manure

	Weight	Nitrogen	Phosphoric Acid - P_2O_5	Potash K_2O
Horse manure	1 ton	11 lbs.	5.5 lbs.	13.2 lbs
Cow manure	1 "	9 "	6.0 "	8.4 "
Cattle manure	1 "	11 "	6.9 "	9.6 "
Sheep manure	1 "	20 "	8.9 "	16.8 "
Hog manure	1 "	13 "	12.6 "	9.6 "
Hen manure	1 "	18 "	17.4 "	9.6 "

Average Composition of Feeds and Fertilizers

	Weight	Nitrogen	Phosphoric Acid - P_2O_5	Potash K_2O
Wheat bran	1 ton	50 lbs.	59.0 lbs.	32.4 lbs
Linseed meal	1 "	118 "	35.4 "	26 "
Cottonseed meal	1 "	120.4"	53.2 "	26 "
Corn gluten feed	1 "	81.2"	12.4 "	4.6 "
Hominy Feed	1 "	34 "	24.8 "	19.0 "
Standard middlings	1 "	54.1"	42.2 "	23.6 "
Meat scraps (over 60% protein)	1 "	202 "	111.6 "	11 "
Blood meal	1 "	263 "	9.8 "	2.4 "
16% Acid Phos.	1 "	0.0"	320 "	0.0 "
2-12-2 Commercial Fertilizer	1 "	40 "	240 "	40 "

FIGURING THE LOSS OF PHOSPHORUS ON THE FARM

Extraction of phosphorus from feeds raised on the farm and consumed by stock plus the leaching of phosphorus from manure produced by this stock results in a total loss of phosphorus estimated at about 1/3 of the original content of phosphorus in feeds consumed. This loss is partly offset by the purchase of feeds. Let us take for example, an average farm where all the crops produced are fed on the farm and the manure produced is all returned to the land on which these crops were raised. We will figure a 33% loss on both the feed raised and that purchased, although a somewhat larger loss is noted in concentrates fed by reason of the higher percentage of digestible nutrients. We will use the figures on the preceding two pages showing the total pounds of phosphoric acid removed per acre by average yields of crops and the phosphoric acid content of 1 ton weights of the various concentrates.

Crops Raised and Phosphorus Removed

Crop	Acres	Total P_2O_5 removed	P_2O_5 returned in manure 2/3	P_2O_5 lost 1/3
Corn silage	10	384	258	126
Ear corn and fodder	10	560	374	186
Clover hay	10	200	134	66
Timothy hay	10	160	107	53
Alfalfa	5	215	144	71
Barley	10	210	140	70
Oats	10	220	147	73
Total	65*	1949	1304	645

Feeds Purchased and Total Phosphates Added

Wheat bran	4 tons	236	154	78
Standard middlings	2 tons	84	56	28
Linseed meal	1 ton	35	23	12
Total		355	233	118

* The average Wisconsin farm has 69 acres of tillable land.

It will be noted that there is a gain of 233 pounds of P_2O_5 in feeds purchased and a loss of 645 pounds P_2O_5 in crops raised and fed. 645 - 233 = 412 pounds P_2O_5 loss each year on this farm.

The equivalent of 412 pounds P_2O_5 in 20% superphosphate = 2060 pounds
The equivalent of 412 pounds P_2O_5 in 45% superphosphate = 915 pounds

In other words, it will be necessary to purchase phosphate fertilizers each year as noted above in order to offset the loss of phosphorus from this farm This amount of superphosphate is sufficient to fertilize 10 acres every year Figure the loss of phosphorus on your farm and see how it compares with this.

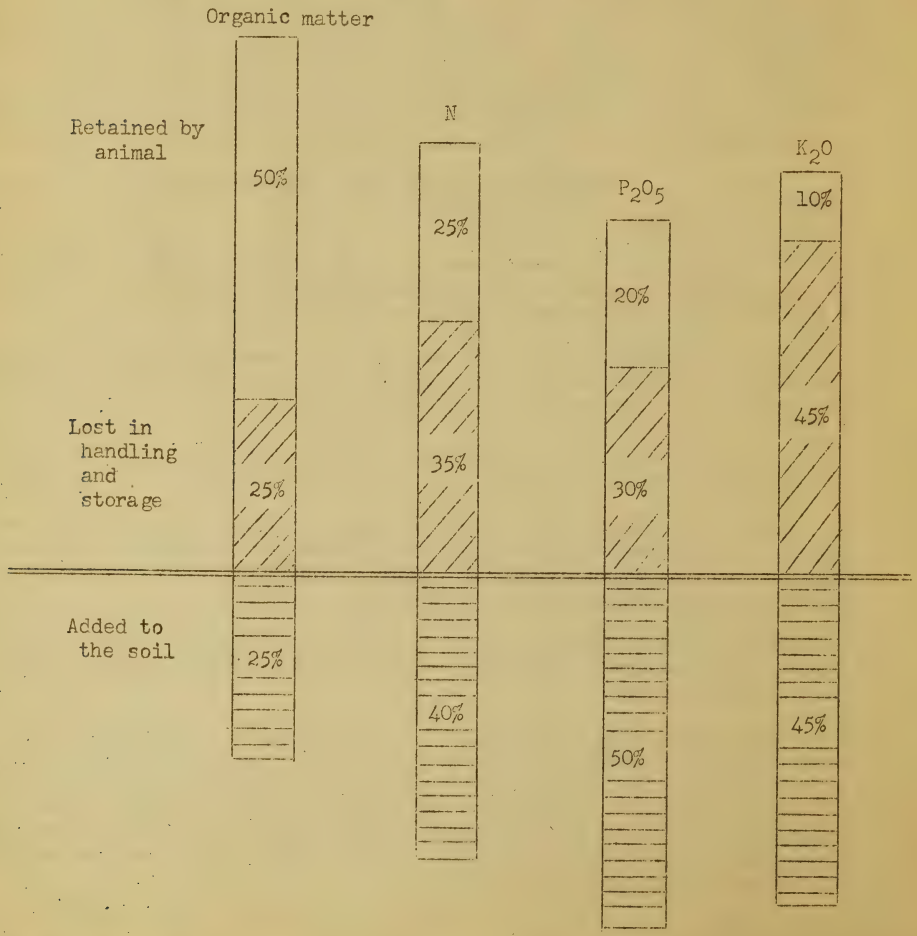
It should be noted further that as the acreage of alfalfa increases, the amounts of concentrates purchased will decrease and the loss of phosphorus will become greater.

Loss of potash may be calculated in a similar manner. Animals retain only about 10% of the potash contained in the feeds consumed, but since its excretion is largely in the liquid manure, loss of potash during manure handling may easily amount to one-third of that in the feeds consumed. Since crops contain three to four times as much potash as phosphate, the losses may become considerably greater than in the case of phosphate, particularly if the manure is not properly handled.

PLANT FOOD LOSSES ON WISCONSIN DAIRY FARMS

The total loss of plant food from Wisconsin livestock farms amounts to the equivalent of over $30,000,000 each year. These losses are sustained through the direct sale of livestock and livestock products, and through the waste of plant food contained in stable manure incurred in handling and storing. Every year on the average farm these losses in phosphorus and potassium amount to the equivalent of over a ton each of 20% superphosphate and 50% muriate of potash. These losses are offset to some extent by the plant food gained in the purchase of mill feeds brought in from other states and in the purchase of commercial fertilizers. However, these gains are small compared with total losses and actually amount to not more than about 15% of the total losses sustained on the average farm in Wisconsin.

The chart below shows the percentage losses of organic matter, nitrogen, phosphoric acid and potash which are ordinarily sustained in the feeding transaction, handling and storing of manure, and the portions which are returned to the soil. (Taken from the chapter on "Manures," Lyon and Buckman's textbook, The Nature and Properties of Soils.)



THE USE OF BARNYARD MANURE

1. Manure is a complete fertilizer. It contains the three elements of plant food: Nitrogen, Phosphorus and Potassium. Phosphorus in a fertilizer is expressed as Phosphoric Acid, and potassium is expressed as Potash.

2. A ton of average manure contains 10 lbs. of nitrogen, 5 lbs. of phosphoric acid and 10 lbs. of potash. A ton of commercial fertilizer such as 4-16-4 contains 80 lbs. of nitrogen, 320 lbs. of phosphoric acid and 80 lbs. of potash.

3. Save all of the liquid manure by using plenty of litter, concrete gutters and concrete manure pits. The liquid portion of manure contains about 75% of the total potash and about 40% of the total nitrogen in both liquid and solid manure.

4. Prevent loss from leaching by storing under cover or in watertight pits.

5. Do not allow manure to heat in piles. Mix horse and cow manure. Keep piles compact and moist.

6. Haul manure directly to the field and apply with a spreader where possible.

7. Too heavy applications of fresh manure to light soils should be avoided. There is danger of "burning out" a soil in a dry season.

8. Manure can be applied to good advantage on new clover or alfalfa seedings or to fall plowed land which is to be fitted for corn.

9. About 3/4 of the plant food elements in crops harvested and fed to livestock is excreted in manure and only 1/4 is sold in milk and livestock. But it takes careful management to get 3/4 back to the field for use by crops.

10. Chemical analysis shows that the plant food alone in a ton of average farm manure would cost $1.75 if bought in commercial fertilizers.

11. On a farm having 20 cows and other customary livestock these animals leave in the stable and yards during the feeding season manure containing plant food which would cost $445 to buy in commercial fertilizers.

12. By careful management, about 90% of this or $400 worth can be saved. By average care about 60% or $267 worth can be saved and by careless management only 40% or $178 worth is saved.

13. Approximately 1/2 of the nitrogen and 2/3 of the potash in manure is found in the liquid portion. This emphasizes the importance of using ample bedding as well as observing other good practices if the value of manure is to be conserved.

14. Both as a means of saving work and preventing losses of plant food it is best, under most conditions, to haul and spread manure directly from the stable. If the ground is too soft or if for other reasons a spreader cannot be used, the manure should be put in fairly deep compact piles so that rain will not cause leaching. When manure is piled it ferments

and part of the nitrogen changes over into ammonia. If manure from such a pile is spread and exposed to the air especially on a dry windy day much of the ammonia escapes into the air resulting in a loss of nitrogen. Under such conditions manure should be worked into the soil just as soon after spreading as possible (preferably within 3 hours).

15. Clover and alfalfa are benefited by top dressing, especially new seedings in the late fall or winter. As a rule, however, most of the manure may better be used on the corn and cultivated crops hauling it out directly from the stable, or, if applied in the spring, working it into the soil immediately.

16. Frequent light applications of manure are advised. At the experiment station larger returns per ton of manure were secured where 4½ tons were applied every third year as compared to 9 tons. 4½-ton applications per acre gave crop increase valued at $3.00 per ton compared to $2.00 per ton with 9-ton applications. "Stretching the manure pile" under present conditions is sound practice.

17. Manure adds some organic matter to the soil but not enough. When fed through livestock nearly 2/3 of the organic matter of a crop is destroyed. A clover crop of 1 ton of hay per acre will, when plowed under, furnish as much organic matter as the manure produced by the feeding of 3 tons of hay, which would be 5 to 6 tons of manure.

A PLAN TO REDUCE LOSSES OF PLANT FOOD IN HANDLING MANURE

WHEN HANDLING FRESH MANURE	WHEN MANURE MUST BE PILED IN YARD
Have tight gutters. Use litter liberally but not to excess. Haul manure to field and spread it daily as produced in winter whenever practicable. If put in small piles from wagon or sled spread at once. Or if frozen, spread as soon as it thaws. Use refuse legume hay as bedding in preference to straw or corn stalks whenever possible--it makes better manure.	Have pit with tight bottom sloping a little toward one end, and low retaining walls on the sides. Mix horse manure and cow manure. Keep pile top level 4 feet or more deep, and with sides nearly vertical. When hauling manure, work from lower end and leave bottom free to shed rainfall. Be sure to disk in within one to three hours.

GREEN MANURING

Excellent green manure crops include alfalfa, clover, soybeans and rye. Green manures are used chiefly for the purpose of maintaining or building up a content of organic matter in soils and increasing the supply of nitrates, especially in the case of the legume green manures.

One ton of alfalfa plowed under returns to the soil approximately 50 pounds of nitrogen taken from the air. Sweet clover and other clovers are comparable to alfalfa in this regard.

Green manure crops have a place only when used in rotations in which grass-legume mixtures are also used, or where used as a "soil conditioner" prior to the seeding of land to alfalfa or permanent pasture. Sweet clover is perhaps the best crop for this purpose and should be seeded in small grains when other legumes are not used. Rye, in addition to being a good cover crop is used as a green manure crop, particularly in cases where one corn crop must follow another.

A heavy rye crop plowed under often depresses the yield of the next crop following.

All green manures are best plowed down when a foot to 18 inches in height.

(Note: Use made of "plowing under" or green manure crops in 8-year Crop Sequence for Sandy Soils on page 16)

Reference: Wis. Circular 296 - "Save Plant Food in Manure" - Feb., 1940

TEST SOILS FIRST

Farmers should be urged to have their soils tested. Most county agricultural agents are equipped to do this work or will send soil samples to the College of Agriculture for analysis upon request. Accurate soil tests will make it possible to make better recommendations regarding soil problems. Farmers who are skeptical about fertilizer results should be encouraged to apply even a small quantity (of type recommended for crop to be grown and on basis of soil test) through the middle of a field to demonstrate possible results.

On the following page are charts and recommendations taken from data available from the Wisconsin College of Agriculture. This information may be helpful in determining types and amount of fertilizer and methods of application that should be used under various soil and crop conditions.

HOW AND WHEN TO APPLY COMMERCIAL FERTILIZERS

Grain: The ideal way to apply commercial fertilizer is with a combination grain and fertilizer drill. The rate recommended on the data sheet should be followed when the fertilizer is applied in this manner.

Fertilizers may also be applied broadcast after the field has been plowed, and when applied in this manner, should be worked into the soil with a disc and harrowed before seeding. For immediate results, the broadcast application is not as effective as the combination drill application. Therefore, the rate should be increased by one-half, or even doubled.

Corn: On upland soils barnyard manure is probably used to best advantage on the corn crop. In addition to an application of barnyard manure, it is usually beneficial to use a small amount of commercial fertilizer which should be applied with an attachment to the corn planter. The fertilizer may be dropped either at the side of the hill or drilled at the side of the row. The recommendations on the data sheet are given for checked corn where the fertilizer is applied at the side of the hill. For drilled corn, the rate of application may be increased by one-half to three-fourths.

In case the recommended fertilizers cannot be obtained through your local dealer, similar lower grade mixtures may be used at proportionately higher rates of application.

References: Wis. - "Wartime Use of Fertilizers and Lime"
Wis. Special Circular - "Use Fertilizers & Lime" - Jan., 1943
Wis. Special Circular - "Soil and Crop Practices in Wisconsin" - Feb., 1941

FERTILIZER RECOMMENDATIONS FOR SOILS WITH CROPS LIS
University of Wisconsin (C.

Crops and Methods of Application	Sands and Sandy Loams		Light colored silt and clay loams	
	Kind of fertilizer	Lbs. per Acre	Kind of fertilizer	Lbs. per Acre
Corn (field)	3-9-18	75 to	3-12-12	100 to
In hill or drill row (1)**	3-12-12	100	3-18-9*	125
Corn (for canning)	3-9-18	100 to	3-12-12	150 to
In hill or drill row (1)	3-12-12	200	3-18-9	300
Small grains with legume seedings	0-9-27	200	0-20-0	200 to
With fertilizer drill (2)	0-20-20	200	0-20-10*	250
Alfalfa & clover (estab. seedings)	0-9-27	250	0-20-0	200 to
Top dress--broadcast	0-0-60	150	0-20-20	300
Pastures	0-9-27	400 to	0-20-10	400 to
Top dress and renovate (3)	0-20-20	500	0-20-20	500
Canning peas	Soils not		3-12-12	200
With fertilizer drill (4)	adapted		3-18-9	200
Potatoes	3-9-18	500	3-9-18	500 to
With attachment on planter			3-12-12	800
Sugar beets	Soils not		3-12-12	125 to
In row with beet drill (5)	adapted			150
Hemp	Soils not		Fertile soil only	
Broadcast or drilled with seed(6)	adapted		3-12-12	400
Cabbage	Soils not		3-12-12	150 to
With attachment on setter (7)	adapted		3-18-9	200
Truck crops	4-10-6	500 to	4-10-6	400 to
Broadcast, in row & or side dress (8)	10-6-4	800	10-6-4	800
Soy beans	0-9-27	400 to	0-20-20	300 to
Broadcast & disk into soil (9)	0-20-20	500	0-20-10	400
Tobacco				
With attachment on setter (10)	3-9-18	200	3-9-18	200

* When 0-14-14 is substituted for 0-20-20, 0-14-7 for 0-20-10, and 2-12-6 for
** Numbers refer to footnotes below.

(1) Manure recommended in addition to commercial fertilizer except for peats and mucks.
(2) If applied broadcast, the rate should be increased by 50%.
(3) When accompanied by reseeding (renovation) fertilizers and lime should be thoroughly worked into the soil during seed bed preparation.
(4) Not more than 200 pounds per acre can be applied safely in direct contact with seed.
(5) Amount in row may be increased to 200 lbs. per acre when beet drill places fertilizer at side of seed. Additional broadcast applications of high potash fertilizer is recommended.
(6) Hemp requires high fertility. The dark colored silt and clay loams are best suited.
(7) Additional broadcast applications are frequently needed.
(8) The kind of fertilizer and rate of application must be adjusted to local conditions, such as amounts of animal manure used and soil fertility. For in-

Reference: Wis. - "Wartime Use of Fertilizers and Lime"

TED by Soils Department, College of Agriculture
J. Chapman and Emil Truog)

Dark colored silt and clay loams		Mucks and peats			
		Acid		Non-acid	
Kind of fertilizer	Lbs. per Acre	Kind of fertilizer	Lbs. per Acre	Kind of fertilizer	Lbs. per Acre
3-12-12 3-18-9	100 to 125	0-20-20* 3-9-18	150 150	0-9-27	150
3-12-12 3-18-9	150 to 300	3-12-12 3-9-18	200 to 400	3-9-18 0-9-27	200 to 400
0-20-0 0-20-10	200 to 250	0-20-20 0-9-27	250 250	0-9-27 0-20-20	250 250
0-20-0 0-20-20	200 to 300	0-9-27 0-20-20	200 200	0-9-27 0-0-60	250 150
0-20-10 0-20-20	400 to 500	0-20-20	300	0-9-27	300
0-20-20 0-20-10	200 200	0-20-20 0-9-27	300 300	0-9-27 0-20-20	300 300
3-9-18 3-12-12	500 to 800	0-9-27	800	0-9-27	800
3-12-12	125 to 150	Soils not adapted		3-9-18	150 to 200
3-12-12 3-18-9	300 to 400	Soils not adapted to crop			
3-12-12 3-18-9	200 250	Soils not adapted		3-9-18 3-12-12	200 to 250
4-10-6 3-12-12	300 to 600	3-9-18 3-12-12	600 to 1000	3-9-18 0-9-27	500 to 1000
0-20-10 0-20-20	300 to 400	0-20-20	300	0-9-27	300
3-9-18	200	Soils not adapted to crop			

3-18-9, the rates of application should be increased 30%.

tensive culture of onions, carrots, cabbage and other vegetables and truck crops, including potatoes, it is desirable under certain conditions to increase the rate of fertilizer application to 1500 pounds per acre.

(9) When fertilizer is drilled in direct contact with seed, use not over 100 pounds per acre.

(10) In most cases additional broadcast application of high potash (sulfate) fertilizer is needed.

Amounts of fertilizer recommended above are for average conditions. When possible, adjust amounts and kinds to the results of soil tests. For general farming--when soil tests show the presence of 75 pounds per acre or more of phosphorus, and 175 pounds per acre or more of potassium, phosphate and potash fertilizers are not needed. Similarly for sugar beets, potatoes and other truck crops, when soil tests show the presence of 125 lbs. per acre of phosphorus and 400 lbs. per acre of potassium, phosphate and potash fertilizers are not needed.

THE EFFECT OF NITROGEN, PHOSPHORUS, AND POTASSIUM ON PLANT GROWTH

The elements nitrogen, phosphorus, and potassium, commonly referred to in commercial fertilizers as ammonia, phosphoric acid, and potash are the critical elements of plant food and the crop producing capacity of a soil is very frequently limited by a lack of one or more of these elements. The fertility of most soils is measured by checking up the supply of these elements in the soil. Calcium, the active element contained in lime, is also a critical element in many soils and is now considered a fertilizer as well as a soil amendment. A more detailed discussion of the benefits derived from the use of lime has been compiled and will be found on page 14. Soil analyses for nitrogen, phosphorus and potassium gives us information as to the total amounts of these elements present in a soil and is an index, when properly interpreted, to the fertility of a soil. But it is very frequently possible to detect a lack of these elements by the characteristic growth of crops.

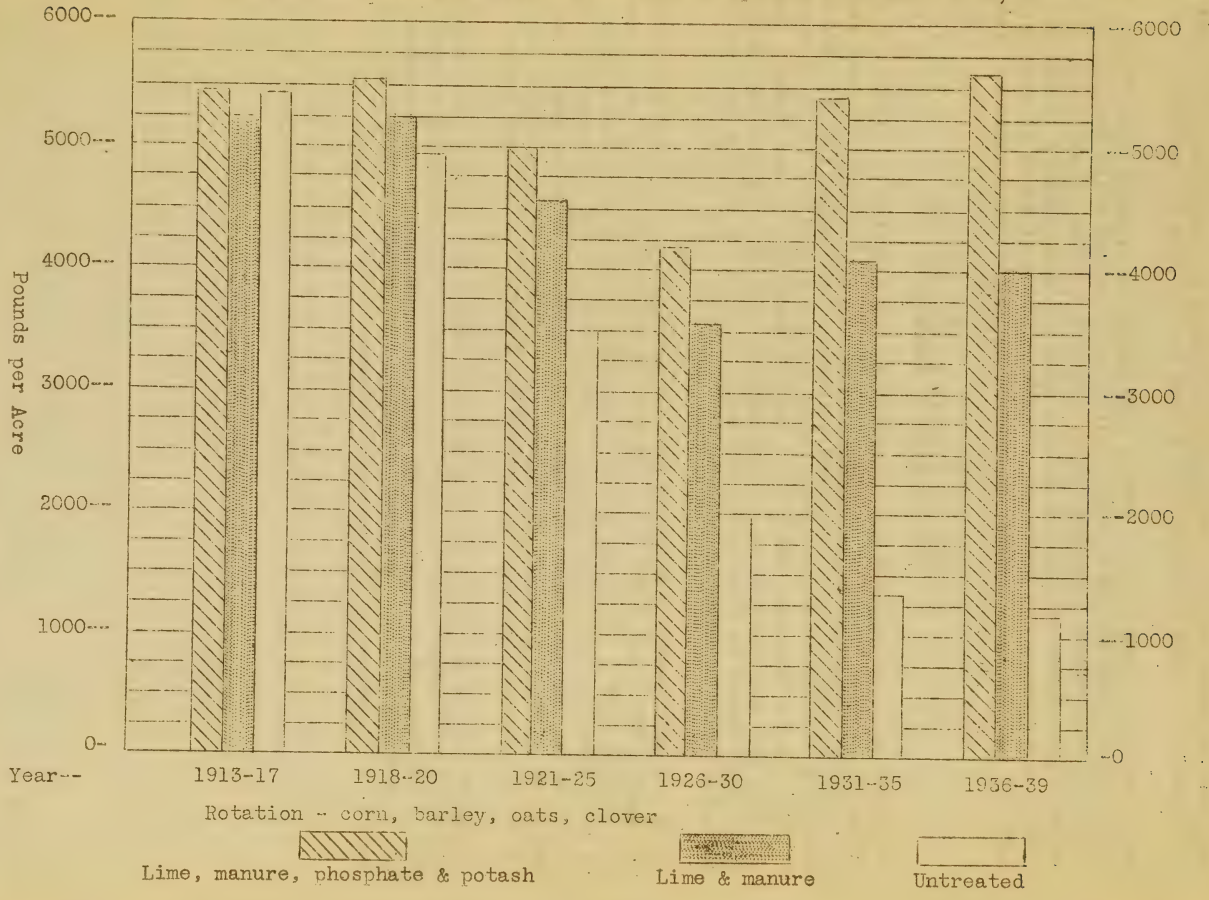
NITROGEN. Nitrogen starvation causes yellowing of the leaf, especially in cold spring weather, absence of growth, and a poor starved appearance generally. Abundance of nitrogen on the other hand results in a bright green color, rank growth of soft sappy tissue and a retarding of the ripening of the crop. Leafy crops like cabbage, lettuce, spinach, celery, etc., respond to liberal applications of nitrogen fertilizers. Soil deficient in nitrogen should be seeded to alfalfa, clover, or some legume, given liberal applications of barnyard manure and a legume sod turned under as a means of bringing up the nitrogen content of the soil. Light colored soils are more deficient in nitrogen than the darker colored soils. Such fertilizers as nitrate of soda, sulphate of ammonia, blood meal, cottonseed meal, tankage, etc. are high in their content of nitrogen.

PHOSPHORUS. It is not so easy to detect a lack of phosphorus from the appearance of a growing crop, as in the case of nitrogen hunger. Phosphorus is closely connected with the maturity of a crop and the formation of seed. The use of phosphate fertilizers will hasten maturity and on phosphorus hungry soils will greatly increase seed production. The use of phosphate fertilizers greatly stimulates root development. This is especially helpful on the heavier clay loams. Winter grain and clover withstands winter freezing and comes through the winter season in much better shape if well supplied with phosphates. Phosphate fertilizers will also greatly stimulate the fixation of nitrogen from the air and the natural processes of nitrification in phosphorus deficient soils. This results in quicker development and the earlier start of plants in the spring.

POTASSIUM. Potash hunger reflects itself in the stunted growth of many crops, the inability of a crop to produce leafy growth and the inability of the crop to produce starches and sugar. Sugar beets, potatoes, cabbage, tobacco, onions, bulb, root and fiber crops in general are heavy feeders on potash. The lack of potash produces a reddish brown tinge on the leaves of such crops as potatoes, beets, tobacco, etc. Most soils are abundantly supplied with potassium, but the availability may be too slow to meet the needs of truck crops. Where the barnyard manure and crop residues are returned to the land there is but little need for potash fertilizers for the general crops on the farm.

Reference: C. J. Chapman, Univ. of Wis.

TWENTY-SEVEN YEARS OF CLOVER YIELDS ON WISCONSIN'S OLDEST FERTILIZER EXPERIMENT
(Marshfield Branch Experiment Station on Spencer Silt Loam Soil)



WISCONSIN SOILS NEED LIME

Although Wisconsin farmers have been applying lime in various forms to their soils for 25 years or more, only 20% of our acid soils have been limed. It has been estimated that we have 6,000,000 acres of sour, lime deficient soils that should be limed to bring back clover or fit them for alfalfa.

While some 6,000,000 tons of ground limestone, marl, paper mill sludge and other liming materials have been applied to Wisconsin soils for the past 25 years, soil tests show that nearly two-thirds of our cropland still requires applications of lime to prepare them for satisfactory growth of alfalfa and clover. In addition, we have millions of acres of permanent pastures that would be greatly improved through the application of lime.

How and When to Apply Lime

When lime is to be applied just previous to new seedings of clover and alfalfa, it is best to spread it after the field has been plowed; then work it in with a disc and harrow before seeding. This places a high concentration of lime within three or four inches of the surface of the soil where it will create favorable conditions for the young clover and alfalfa plants and also for the bacteria of the inoculation culture. If applied in the fall, lime should be disced into the soil in order to prevent loss by wind and water erosion during the winter.

It is not good practice to apply lime before plowing and immediately turn it under. This places the lime below the feeding zone of the young clover and alfalfa plants and as a result they will not be greatly benefited. If it is desired to apply lime a year in advance of legume seedings, the application may be made after the field is plowed for the corn crop. For the grain and legumes which are to follow, it is better to disc rather than plow the field in order to keep the lime in the first three or four inches of soil.

Limestone or any material containing lime, should be applied where needed in amounts determined by soil testing. Since ground limestone is used in most instances, it is important to have the proper degree of fineness. At least 45 percent of the material should be fine enough to pass a 60-mesh screen, or a screen as fine as a milk sieve.

References: Wis. Special Circular - "Use Fertilizers & Lime" - Jan., 1943
Wis. Circular 266 - "Liming Wisconsin Soils" - Rev. Nov. 1936

BENEFITS FROM THE USE OF LIME ON SOUR SOILS

1. Lime sweetens a sour soil by entering into combination with certain acid compounds in the soil.

2. Lime promotes the decay of vegetable matter in the soil and thus aids in the formation of humus.

3. Lime, by sweetening the acid soil, favors the growth of most legumes, such as clover, alfalfa, and peas. These legumes are thus enabled to use the nitrogen of the air through the action of the bacteria in the nodules on the roots of these plants.

4. Lime is required as a plant food by all crops. Some crops require more than others. The degree to which a plant is affected by an acid soil depends on the special need of lime by that plant, the plant's ability to get the lime out of the soil, and the period of time necessary to make its growth.

5. Lime improves the tilth of the heavy soil by making it more friable and loose. Soils which have a tendency to work up lumpy are especially benefited. Lime makes sandy soils more compact.

6. Lime helps to keep phosphate fertilizers which have been applied to the soil in a more readily available condition and may even help to liberate some potash and nitrogen in the soil.

Forms and Kinds of Lime for Soils

(1) Pulverized limestone rock, (2) Marl, (3) Quick Lime, (4) Air-slaked lime, (5) Hydrated lime, (6) Pulverized clam or oyster shells.

Crops which are Greatly Benefited by Liming

Cabbage, lettuce, spinach, beets, onions, cauliflower, celery, peas, barley, tobacco (too much lime may cause root rot), squash, pumpkins, canteloupe, rape, alfalfa, sweet clover, red clover, Kentucky blue grass, hops, mulberry, red raspberry and currants.

Crops which will Tolerate a Slightly Acid Condition

Corn, rye, potatoes, oats, alsike clover, strawberry, red top, carrots and radishes. (All of these crops may be slightly benefited from applications of lime.)

Crops which May Be Injured from Liming

Cranberry, black-cap raspberry, blackberry, flax, watermelon.

The Application of Lime to the Soil

1. Lime in the form of pulverized limestone should not be applied as a top dressing but should be applied after the land has been plowed and thoroughly mixed with the soil by dragging and discing. Lime should not be plowed under.

2. Lime should be applied preferably in the fall in order that it may have time to react with the soil acids.

3. Apply lime with a Lime sower, manure spreader, or by hand.

CROPS AND ESSENTIAL OPERATIONS OF AN 8-YEAR CROP SEQUENCE FOR LIMED SANDY SOILS

By A.R.Albert
Jan. 1941.

Tillage Boxed

Soil Treatments Underscored

PLOW UNDER RYE IN SPRING

1. POTATOES, CORN, SOYBEANS, VINE CROPS, etc.
Plant mostly in check for easier weed control. Even soybeans may be check-hilled (8-10 per hill) when weeds are bad.

Crop MAY be fertilized at planting with a mixture and at a rate suitable for the crop.

DISK OR SPRINGTOOTH IN FALL, If Weedy or Trashy, PREPARE A SEED BED IN SPRING.

2. OATS or SPRING WHEAT - Early oats at 4-5 pks; wheat at 3-4 pks.
Apply phosphate and potash in ratios ranging from 0-1-1 to 0-1-3 at 250-400 lbs. per acre of highest analysis mixture readily obtainable with grain-fertilizer drill or broadcast before fitting the land.

Seed down (inoculating legumes) with straight alfalfa, alfalfa mixed with red OR sweet clover, or alfalfa mixed with timothy OR Brome grass. Brome grass would be mixed and drilled with grain.

3. ALFALFA - Hay. (DO NOT PASTURE)
While in alfalfa apply the maintenance dose of 1 ton of lime per acre or equivalent of other liming materials.

4. ALFALFA - Hay - Seed - Pasture
Rye can be drilled into alfalfa sod in fall when more grain and less hay is desired the following year unless 2nd growth seeds.

5. ALFALFA - Hay - Seed - Pasture, or
RYE for Grain or Pasture with OLD ALFALFA growing with it.
During winter and spring spread manure as produced on ALFALFA sod, whenever possible. (See also Wis. Circ. No. 296.)

PLOW UNDER ALFALFA AND MANURE IN MAY

6. CORN
Plant so as to have 4-5 sq. ft. of soil per plant of corn. Drill rye between corn rows or after silage corn harvest.
Topdress manure during fall and winter on rye at one-half rates.

7. RYE for Grain and Straw. See also Wis. Circ. 301.
Topdress in April with 300# per A. of 0-10-25 or similar fertilizer.
Seed down to Sweet Clover, using plenty of seed,
a. In late November with unhulled or unscarified seed,
b. Before last spring snowfall, or
c. In April after disking back rye.
d. Should previous seeding fail, immediately after rye harvest
Note: To utilize "a" and "b" above, soil must be known to have alfalfa or sweet clover nodule bacteria present.

8. SWEET CLOVER - Pasture - Seed
Drill (1½ bus.) or disk in (2 bus.) rye in late August

PLOW UNDER RYE IN SPRING (Sequence Completed)

CONSERVATION FARMING

Proper Land Use

All agriculture is based on the food manufactured by plants and these, in turn, are dependent on the soil. The returns from farming are determined partly by the selection of the land to be used for crops.

In planning the use of the land, those areas that are too steep, too infertile, or too badly eroded should not be used for cropland. Of these areas, those that will support good pasture may be used for that purpose and the balance for woodland. When the land to be used for cropland has been decided upon, plans should be made for maintaining or improving its productive capacity. These plans may include provisions for drainage, liming, fertilizing, manuring, suitable rotations and erosion control.

Principles of Soil Erosion Control

Wherever water runs over unprotected soil rapidly enough to carry soil particles, erosion will occur. Any process which will reduce the amount of water running over the surface, slow down the speed of water, cover the soil, or hold the soil particles together, will tend to reduce the erosion.

The amount of water running over the land can be reduced by causing more of it to filter into the ground. This is done by increasing the organic matter and masses of roots, thus loosening the soil. It can be accomplished by stopping the water until it has time to percolate into the soil, as is done in contour cultivation. The amount can also be reduced by carrying off excess water in channels on the slope as in terracing.

The speed of water can be reduced by the use of obstructions in its path, such as thickly growing vegetation. It can also be reduced by changing the grade on which the water runs, as is done with contour cultivation or terracing.

The soil can be protected by having sufficient vegetation on the surface to protect it from hard rains and running water and by increasing the organic matter and roots in the soil. Even after such land is plowed, it is partially protected for a time by the binding action of roots and organic matter and the loose structure which facilitates percolation of water into the soil.

The principles of wind erosion control are similar to those used to control water erosion. An attempt must be made to cover the soil, bind the soil particles together, or reduce the amount and velocity of the wind. This is done by increasing the vegetative cover or by using windbreaks of trees or other plants to reduce the speed of the wind, at the surface of the soil.

Conservation Farming Practices

Planning for conservation farming includes a few special techniques for the control of erosion, but many of the measures required are those involved in good husbandry of the soil, and are already covered in other

parts of this handbook under the headings of lime and fertilizer recommendations, [illegible].

The accompanying table of land use recommendations is applicable to the major portion of the agricultural land in the southern part of the state. More detailed recommendations are available in the counties where soil conservation districts have been organized. Further details are included in the references given below.

References:

Wis. Bulletin 452 - "Cropping Systems that Help Control Erosion" - June, 1941
U.S.D.A. Farmers' Bulletin 1853 - "Classifying Land for Conservation Farming"
U.S.D.A. Misc. Pub. 394 - "Farms the Rains Can't Take"
U.S.D.A. Yearbook of Agriculture 1938, pages 581-692
U.S.D.A. Farmers' Bulletin 1795 - "Conserving Corn Belt Soil"
U.S.D.A. Farmers' Bulletin 1606 - "Farm Drainage"
McGraw-Hill Publishing Co. - "Soil Conservation" - by H. H. Bennett

GENERAL LAND USE RECOMMENDATIONS
SOUTHERN WISCONSIN

April 12, 1943

	LAND CLASS	TYPE OF LAND	SLOPE	*ROTATIONS OR LAND USE		**PRACTICES
SUITABLE FOR CULTIVATION	I	a. Level deep upland or bench - well drained	2% or less	C-G-H	with	No practices
		b. Bottomland - well drained - periodic overflow	2% or less	C-C (Green manure)	with	No practices
	II	a. Deep upland or bench - well drained - slight to moderate erosion	3-10%	C-C-G-H-H-H	with	Terraces
		or		C-G-H-H	with	Contour strip cropping
		or		C-G-H-H-H	with	Field or buffer strips
		or		C-G-H-H-H-H	with	No practices
		b. Bottomland or bench with fair or imperfect drainage	2% or less	C-G-H	with	Drainage
		or		C-C-G-H-H-H	with	No drainage
	III	a. Deep loam or silt loam, upland or bench - well drained with moderate to severe erosion	15% or less	C-G-H-H	with	Terraces
		or		C-G-H-H-H	with	Contour strip cropping
		or		C-G-H-H-H-H	with	Field or buffer strips
				G-G-H-H-H-H-H-H	with	No practices
		b. Shallow silt loams or sandy loams on uplands or benches	2% or less	C-G-H-H	with	Field strips
			3-10%	C-G-H-H-H	with	Contour strips
		or		C-G-H-H-H-H	with	Field or buffer strips
		or		Permanent pasture	with	Pasture renovation
		c. Moderately drained peat & muck over clay and low to moderately productive bottomland	2% or less	C-G-H	with	Drainage
		or		Special crops		Special fertilizers
	IV	a. Upland, too steep or severely eroded or too shallow for clean tilled crops	20% or less	G-G-H-H-H-H	with	Narrow contour strips
		or		Permanent pasture	with	Pasture renovation
		b. Upland or bench loamy sands	6% or less	C-C-H-H-H-H-H-H		Wind strips & wind brks.
		or		C-G-(SC)-C-G-H-H-H		Wind strips & wind brks.

* C = row crops G = small grain H = hay or pasture (SC) = sweet clover for green manure

** Manure, lime and fertilizer applied as required.

General Land Use Recommendations for Southern Wisconsin (cont'd)

	LAND CLASS	TYPE OF LAND	SLOPE	*ROTATIONS OR LAND USE	**PRACTICES
SUITABLE ONLY FOR PERMANENT VEGETATION	V	a. Bottomland well drained, frequently overflowed - meandering streams	2% or less	Pasture	No practices
		b. Bottomland - poor drainage	2% or less	Pasture	Seed Reed's Canary Grass
	VI	a. Hillside, too steep or too shallow for cultivation (or too severely eroded)	30% or less	Pasture	Control grazing Pasture renovation
		b. Upland drainageways or alluvial fans, frequently overflow	15% or less	Pasture	Control grazing
	VII	a. Very steep or severely eroded or stony or	0-70%	Woodland or wildlife Pasture	Protect from fire & grazing - selective cut Control grazing
		b. Level to steep, droughty sands	0-40%	Woodland or wildlife	Tree planting - protection

* C = row crops G = small grain H = hay or pasture (SC) = sweet clover for green manure

** Manure, lime and fertilizer applied as required.

SECTION IV - GRAIN & FORAGE CROPS

(Continued)

PAGE

Depend On
BROME GRASS and ALFALFA
for Pasture for Hay*

Wisconsin farmers have needed for a long time a hardy, rugged, drought tolerant, perennial forage capable of producing good yields of hay and an abundance of nutritious, succulent and palatable pasturage. Bromegrass (Bromus inermis) fills the bill and is entitled to stand high on the state's forage plant list.

Bromegrass-Alfalfa Supplies Pasture Insurance

1. The advantages of using bromegrass with alfalfa are gained only in long rotations which include hay or pasturage for 3 or more years.

2. The grass is slow to become established. Usually 2 years are required to develop a good stand and when grown in "pure stands" it may become "sod bound" in 3 or 4 years. Bromegrass that is "sod bound" is generally yellowish in color, stunted and poor in yield.

3. The drop in yield of "pure stands" is believed to be due in part to nitrogen starvation. But when alfalfa is seeded with the bromegrass, it remains highly productive for a year or two after the alfalfa has disappeared. If moisture conditions are favorable, bromegrass can be kept producing well after alfalfa has died out by making annual applications of commercial fertilizer.

4. Bromegrass, grown in combination with alfalfa, produces better than timothy grown with alfalfa in rotations of long duration. Since this forage establishes itself slowly it is not likely that any advantage is to be gained by using it in 3 or 4 year rotations which include only one or two years of hay or pasturage.

It's a Partner of Alfalfa

1. Bromegrass is a long lived, extremely winter-hardy and drought resistant perennial. It can withstand drought about as well as can alfalfa, remaining productive and succulent during dry periods when most other grasses are dried and dormant. Besides bromegrass begins growing very early in the spring and continues to grow late into the fall.

2. The plant produces short underground rootstocks which form a dense sod in 2 or 3 years. Its fibrous roots may penetrate the soil to a depth of six feet or more. It is not hard to clear it from a field for a cultivated crop.

3. Under average conditions bromegrass grows to a height of 2 to 4 feet. The grass is palatable to all classes of livestock either for hay or

*The growing of Bromegrass with alfalfa is a new feature that is being recommended by the College of Agriculture and, therefore, incorporated in this handbook.

pasturage and is approximately equal in feeding value to the best timothy.

4. As with most grasses, there are few well recognized varieties of bromegrass. The two types which are generally available are a creeping form known as common bromegrass and another having a tendency to form bunches and be less spreading. Though yields of the two types are quite similar under conditions at Madison the creeping type tends to provide a better ground cover as the alfalfa kills out.

Bromegrass with alfalfa is dark green and highly productive; while a "pure stand" is stunted, yellowish green in color and poor in yield. Bromegrass should not be planted alone.

Plant Does Best on Well Drained Fertile Soils

This crop will do well on most any well drained fertile soil. It can, however, be grown on soils of low fertility and on sandy soils in combination with alfalfa. However, it is less easily established and is not as productive under these conditions. Any soil treatments which are required for the successful establishment of alfalfa will also favor bromegrass.

Care Needed in Seeding Bromegrass

The seed of bromegrass is large and light in weight. That's why it will not pass through ordinary grass seeding attachments. The seed must be mixed with the grain nurse crop and seeded with the grain or be broadcast by hand when it is not windy. Care must be taken to plant the bromegrass shallowly when mixed with grain, not more than 1 to 1½ inches. The seeding should be made as early in the spring as a good seedbed can be prepared.

A mixture of 6 to 8 pounds of alfalfa, 3 to 4 pounds of red clover and 6 to 10 pounds of bromegrass may be used on heavy soil. Six to 8 pounds of alfalfa and 6 pounds of bromegrass are enough for sandy soils. Nurse crops, which ripen early - seeded in moderate rates - help assure a stand. Where the grain grows extremely rank a short period of grazing in the early spring or cutting the grain for hay will help to safeguard the seeding.

It Pays to Manage the Crop

Bromegrass, grown with alfalfa, can be used to advantage for hay, pasturage or grass silage. The yield of hay may vary from 2 to 4 tons per acre. Similarly, alfalfa and bromegrass are highly productive when pastured. In fact this combination provided more forage per acre in the summer of 1942 than did any other crops used for pasturage on the University Farms at Madison.

1. When bromegrass and alfalfa are used for hay the crop should be cut when the bromegrass is in the bloom stage.

2. As bromegrass needs to be grown with alfalfa in order to do well, fields sown to bromegrass-alfalfa should be so managed as to safeguard the alfalfa as much as possible. Mixtures of alfalfa and bromegrass should

not be harvested for hay or grass silage oftener than twice a year - this will help to keep the stand of alfalfa in better vigor.

3. The best general plan of management appears to be one in which the alfalfa and bromegrass are harvested for hay during the first year or two although the second crop is sometimes pastured at this time. During the first two years the forage is often predominantly alfalfa. By the second or third year the bromegrass develops a sod and it may comprise 50% or more of the total forage. At this time the first crop may be cut for hay and the second growth pastured or, by judicious grazing and careful management, the bromegrass and alfalfa may be used entirely as pasturage. This would appear more practical, however, as the stand becomes older.

4. As soon as the bromegrass makes a good sod, it may be grazed uniformly and heavily for about a week in early spring if the ground is firm and after the bromegrass has made a growth of two or three inches. Bromegrass is like rye in this as it is among the first of the grasses to start growing in the spring. The early spring grazing reduces competition between the alfalfa and bromegrass - giving the alfalfa a better chance. If the first crop is to be cut for hay it delays cutting and provides a finer and better hay.

5. After the first grazing, the field should be grazed in rotation throughout the growing period. This permits the plants to make at least a 5 to 8 inch of regrowth following each grazing. At Madison, bromegrass grazed whenever the forage was 2 to 3 inches tall produced only 54% as much forage as bromegrass harvested at the hay stage of growth. On the other hand, bromegrass grazed when the forage was 5 to 8 inches tall, produced 90% as much forage as bromegrass harvested at the hay stage.

6. The fields should not be grazed after mid-September and in early October or until growth has been stopped or retarded by frost or cold weather. Light grazing after that time will cause little or no damage to the alfalfa or bromegrass.

Guard Against Hazard of Bloat

There is danger of bloat in grazing alfalfa-bromegrass pastures especially during the first year or two following seeding because of the predominance of alfalfa. But as the stand becomes older, the bromegrass provides an increasing proportion of the total yield of forage. Danger of bloat is thus reduced considerably in grazing older fields of alfalfa and bromegrass because of a natural increase in the stand of bromegrass and a corresponding decrease in the stand of alfalfa.

Cattle should not be turned into alfalfa-bromegrass fields when they are hungry or if the forage is wet with dew or rain, especially if the stand is comprised mostly of alfalfa. It helps to prevent bloat if livestock, grazing forage which is predominantly green succulent alfalfa, have ready access to dry hay, straw, or other grassy pastures and to plenty of salt and water. Frosted or frozen alfalfa may cause intestinal disorders if the livestock graze it before the forage has dried out.

Reference: Wis. Stencil Cir. 231 - "Depend on Bromegrass and Alfalfa" - Feb., 1943

RECOMMENDATIONS FOR PASTURE AND CROP PRODUCTION

I. Stretch the Seed Supply

A. Extend the limited supplies of seed of hay and pasture legumes

1. By fortifying the soil with adequate lime, phosphate and potash before seeding;

2. By preparing a good firm seed bed;

3. By cutting the rates of seeding made possible

a. by sowing shallow on all heavier soils;

b. by seeding on the surface of heavy soils and harrowing or rolling in;

c. by using a cultipacker seeder on sandy soils and on heavy soils when surface is dry;

4. By sowing mixtures of alfalfa, red clover and bromegrass or timothy on heavy soils (6 to 8 pounds of alfalfa, 3 to 4 pounds of red clover and 6 pounds of brome grass or 2 pounds timothy) (6 to 8 pounds of hardy alfalfa and 6 pounds of bromegrass are enough for sandy soils);

5. By sowing mixtures of 7 pounds yellow sweet clover, 4 pounds of alsike and 4 pounds of timothy on heavy loam soils of northern Wisconsin not suited for alfalfa;

6. By grazing or clipping grain when 8 to 12 inches tall if necessary to save moisture for seedings on droughty soils;

7. By using only adapted varieties of alfalfa such as Cossack, half Cossack and half Ladak, Grimm, Canadian variegated and the common strains of such origins as Wisconsin, Minnesota, South Dakota, Kansas, Nebraska and Montana;

8. By inoculating the seed with fresh cultures.

B. Insure the Corn Crop

1. Use hybrids which have made good in your locality;

2. Plant seed corn which has been treated (all Wisconsin hybrid seed corn is treated with dust disinfectants to insure better stands by the prevention of excessive seedling losses due to soil and seed borne diseases);

3. Delay planting date until weather conditions are better if small or old seed is used;

4. Use a complete fertilizer to assure a rapid early growth and early row cultivation for weed control, also earlier maturity.

C. Get better stands and yields of soybeans for grain

1. By using seed of highest germination obtainable;

2. By inoculating the seed with fresh cultures--this is very important;

3. By using varieties which will mature for grain;

a. Mandarin 507 for shortest seasons;

b. Mandarin 507 and Manchu 606 for intermediate seasons;

c. Manchu 606, Manchu 3 and Mukden for regions with the longest growing season;

d. Common Manchu and Illini only as last choice in southern tier of counties;

4. By using earlier varieties such as Manchu 3, Manchu 606, and Mukden even in southern Wisconsin for delayed plantings;

5. By killing weeds before planting even if delay in planting is necessary;

6. By planting in rows especially if soil is weedy;

7. By keeping soybeans off soils subject to excessive erosion.

II. Produce Ample Supplies of Hay and Pasture Legume Seeds for Domestic and Foreign Use

A. By leaving some of the promising fields of the first or second crop mature if weather conditions are favorable for seed setting.

III. Produce Feed for Wartime Food Needs

A. Sow Vicland Oats -- available supplies should be used for seed in 1943 because it is one of our highest feed producing grains.

1. Insure the 1943 oat crop against the hazards of rusts and smuts which reduced the 1941 oat crop by 30% or more. This need not happen again if Vicland oats are sown;

2. Sow on fertile soils as early as the land can be properly worked (2 bushels per acre give satisfactory yields).

B. Renovate unproductive bluegrass pastures

1. By disking lime and fertilizer into the soil as needed;

2. By disking the sod at frequent intervals to thoroughly prepare a good seed bed;

3. By sowing 5 pounds red clover and 12 pounds sweet clover and 1 bushel oats per acre on thoroughly torn up sod (if preferred, replace sweet clover with 10 pounds alfalfa on better soils or where sweet clover weevils cause losses in new seedlings of sweet clover);

4. By grazing the oats moderately as it heads out;

5. By protecting from grazing again until late in the fall during the year of seeding.

C. Improve quality of alfalfa and clover forage

1. By putting up grass silage;

2. By close uniform grazing of strong healthy fields just after spring growth has gotten well started (or clipping when not more than 5 inches tall if ground is soft or hazards of bloat are feared);

3. Only strong healthy fields not more than 2 years old should be spring grazed or clipped;

4. Graze young alfalfa or clover closely and uniformly for not more than 7 days in the early spring;

5. Grazing or clipping about one-third the hay acreage delays the first cutting from 10 to 14 days and helps stagger haying operations;

6. Grazing or clipping lowers yield by as much as 25 per cent but the quality of the hay is greatly improved.

7. Spring grazing or clipping of old fields or of any fields that have been winter injured is hazardous.

D. Use emergency hays and pastures

Conditions in 1942 favored the rapid spread of bacterial wilt disease in alfalfa fields--because of this and winterkilling many fields may be badly thinned out for 1943--this will necessitate the use of emergency hays and pastures.

E. Sow sudan grass for midsummer grazing

1. It's highly productive during July and August;

2. It grows vigorously on warm fertile soils where 105 day corn matures;

3. Sow 30-35 pounds per acre shortly after corn planting time;

4. Allow about one-half acre per cow;

5. Defer grazing until plants are 2 feet tall or more.

F. Sow soybeans for hay

1. Use varieties too late for grain, if necessary.

2. Drill in at rate of 2 bushels per acre of inoculated seed on fertile soils. Sow from corn planting time to June 20. In making high quality soybean hay good curing weather is more important than the stage of maturity. Soybean hay is not easily dried; it cures slowly.

G. Sow millets if needed.

1. In regions too cool for sudan grass;

2. Must be cut early for satisfactory hay;

3. Sow shallow at rate of 20 to 30 pounds per acre;

4. Use German, Hungarian, Common and Japanese varieties (6 to 8 pounds of millet or a bushel of oats with 90 pounds of soybeans is better than millet alone for grass silage or hay.)

IV. Sow Crops Important to the War

Certain areas in the state, because of particular soil and climatic conditions, are especially adapted to the production of specialized crops. An increased production of field peas for soup is being requested in the heavier and fertile soil areas of northern and eastern Wisconsin. Likewise, peas and sweet corn are needed for canning, soybeans and flax for oil, and hemp for fiber in regions in which they are adapted.

V. Control Weeds

A. By killing before sowing or planting the crop;

B. By seeding clean (weed free) seed;

C. By doing a better job of cultivation;

D. By using chemicals on small patches;

E. By preventing weeds from maturing seed.

VI. Control Soil Erosion

A. By maintaining grass waterways to carry off excess water;

B. By round-the-hill plowing and cultivating of sloping lands;

C. By strip cropping;

D. By using steep slopes for pasture and rough land for protected wood lots.

E. By keeping in hay and grass fields likely to wash -- don't put cultivated crops on land that should be used for pasture.

F. By increasing the production of erodable land through renovation thereby reducing the necessity of producing cultivated crops on this land.

VICLAND OATS

Developed by plant breeders of the University of Wisconsin and the United States Department of Agriculture. First released by the Wisconsin College of Agriculture in 1941 for seed production.

Reports from Wisconsin certified seed producers in 1941 and 1942 show an average increase in yield of one half over yields of the varieties commonly grown in the same neighborhoods. This farm performance agrees closely with the results of University tests.

Vicland is a short strawed yellow oat. Some outstanding characteristics which partly account for its remarkable yielding ability are: A high degree of resistance to rusts and smuts -- Early maturity whereby it usually ripens ahead of hot dry weather -- High weight per bushel -- Yellow color -- Plump seed.

Reports from trials in other states are very favorable, showing that Vicland has a wide range of adaptation where early oats are grown.

CAUSES OF LODGING

1. Soils high in nitrogen -- too much manure.

2. High moisture during growing seasons.

3. Heavy rates of seeding (too thick stands).

4. Spring plowing (loose open soil) often disk instead of plowing in spring on corn ground if not too weedy.

5. Weak strawed varieties (some varieties resist lodging much better than others).

6. Storms (especially just before or at heading time).

7. Rust (rust makes the straw weak and brittle).

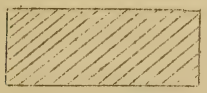
Reference: Wis. Sp. Cir. - "Field Crops in '43" - Jan., 1943

PLANNING THE PASTURE PROGRAM

The pasture plan for the farm is based on the permanent pasture acreage, and other types of pasture are fitted in as needed to furnish sufficient quantity, quality and continued productivity throughout the season. The following chart shows suggested pasture possibilities which can be used to provide this type of pasture. The figures given are for average conditions.

SUGGESTED POSSIBILITIES FOR SEASONAL PASTURE PLANNING

Pasture	May	June	July	Aug.	Sept.	Oct.	Expected Carrying capacity per acre in cow pasture days
Rye	20	10					30
Nurse crop	15	15					30
Blue grass	15	30	10	10	10		75
Blue grass Renovated		25	35	35	15	10	10 130
Alfalfa Old Grassy		20	30	30	10	5	5 100
Sweet Clover Second Year	10	40	40	35	10		135
Sudan Grass			20	45	25		90
Alfalfa Second Crop				30	15	5	50
Canary Grass	10	25	25	25	25	15	125
Meadow Aftermath				10	20	10	40



It is suggested that this period be filled by using first crop alfalfa preserved as grass silage. Alfalfa should not be grazed during this period.

Reference: Wis. Circular 298 - "Plan Wisconsin Pastures" - March, 1940

SORGHUM*

Some sorghums are very satisfactory in Wisconsin but there are others which have no place in this state. Those known as sweet sorghums and commonly called "sorgo", "cane", "sorghum cane" or "sorghum" are useful here, while the grain sorghums such as kafir, milo, feterita and the like are not adapted.

While the crop is most commonly used by Wisconsin farmers for sirup during the last few years they have found adapted varieties of sweet sorghum very satisfactory for silage and for other forage use.

What Varieties to Plant

Rox Orange is the best variety of sweet sorghum for Wisconsin. It is a medium early maturing kind which was originated by the Wisconsin Agricultural Experiment Station. It was developed primarily as a sirup sorghum and has proved decidedly satisfactory for that purpose. It has also been found to be the best variety for silage in Wisconsin.

Rox Orange does best in central and southern Wisconsin, where in most seasons it will produce ripe seed and in practically all seasons it will mature sufficiently to be satisfactory for silage.

Seed of the Rox Orange variety is also distributed under the name of Waconia. The only difference of consequence is that the Rox Orange is distributed as certified seed (tagged and sealed) while under the name of Waconia the seed is not certified and is more likely to be mixed with other varieties.

Early Black Amber is from a week to ten days earlier than Rox Orange but the stalks are slender and relatively tall and are subject to lodging. There are no established varieties of early black amber and there are many local strains varying much both in maturity and productiveness, which are sold under the same name. Usually, however, seed listed as Minnesota Amber or Early Amber -- if produced in the northern states -- is reasonably reliable as to maturity.

Leoti Red is about the same in maturity as Rox Orange and is a reasonably good variety for silage, for forage and for sirup but it lodges very readily and consequently is less satisfactory.

Atlas Sorgo is definitely too late maturing to be depended upon for any use in Wisconsin. There are seasons in which it gets sufficiently ripe to be satisfactory for silage but it is hazardous even for that purpose. It is very productive and were it not for its late maturity it would be very useful in this state.

Grain sorghums, such as kafir, milo and feterita are not adapted to Wisconsin. Early Kalo, another grain sorghum, will usually mature in Wisconsin but is unproductive and otherwise unsatisfactory.

* The growing of Sorghum in Wisconsin is relatively new. Therefore we have incorporated it in this handbook.

When to Plant Sorghum

On fertile sandy soils which are reasonably free from weeds and which warm up quickly in the spring, sorghum can be planted about the same time as corn. On the heavier and colder soils it is best to delay planting until the soil is sufficiently warm that prompt germination and rapid early growth can be obtained. Sorghums grow slowly in cool soils and cool weather. They are "hot weather plants" and because of their slow growth in the spring the problem of weeds is decidely serious. For this reason time of planting should be adjusted to the soil and the season so that early rapid growth can be obtained.

What Rate of Planting?

If the crop is to be used for sirup the rate of planting should be thinner than if it is to be used for silage. Also thinner planting is better on sandy soils than on heavy soils. For sirup purposes from two to four pounds to the acre are sufficient. For silage the rate may range from five to eight pounds. When grown for sirup the size of the stalks is important and consequently thick planting is not desirable. Because sorghum grows slowly and does not compete successfully with weeds in the early part of the season, the general practice is to plant it rather thickly in order to insure a stand and to permit of covering up some of the plants during the early cultivations.

How to Plant the Seed

For small fields to be used for sirup, sorghum is often planted by hand or with a hand planter. But since the crop is being used rather extensively for silage and for forage, planting with a corn planter is a common practice.* Most corn planter plates intended for planting sorghum result in too thick a stand. Usually it is necessary to get blank plates and make the desired holes (cells). The seed is planted by either drilling, hilling, or check rowing. The distance between rows may be the same as for corn (40 to 42 inches). Some, however, plant in rows as close as 36 inches.

Grow Sorghum Alone

While the practice of planting sorghum and corn in the same field (alternating two rows of one with two rows of the other) is followed here to a

*For planting seed of Rox Orange, with a John Deere corn planter use plate No. Y3314-B and filler ring Y3313-B. Those who have other makes of planters will probably find it necessary to obtain blank plates and to drill the proper sized holes. These should be 11/64 inches in diameter and after drilling the holes should be reamed from the bottom side at an angle about 30 degrees from the vertical. Proper reamers are rarely available but a satisfactory reamer may be made up grinding down a large drill bit to the desired angle. Or another way is to grind a taper on the end of a three cornered file. Use an old file and break it off two or three inches below the handle and then taper the broken end of the portion attached to the handle. In reaming out from the under side of the plate do not ream all the way through but leave a ledge of at least 2/64" between the top of the plate and the beginning of the bevel.

considerable extent it is not a satisfactory practice. Sorghum seed should be planted considerably shallower than corn and this is nearly impossible where one planting box is filled with sorghum and the other with corn and both planted at the same time. Nor does the practice of mixing sorghum with corn and planting both in the same row work out very well -- the sorghum is usually planted too deep.

What Fertilizers for Sorghum

On most soils sorghum is benefited by using commercial fertilizers. Use the same fertilizer and apply at the same rate as for corn and if applied in the drill or the hill (row application) be sure that the fertilizer is not drilled directly in contact with the seed. When sorghum is grown for sirup, it apparently needs a fertilizer proportionately high in potash.

When Grown for Silage

Wisconsin farmers have learned that sweet sorghum makes very satisfactory silage. It is about 90% as good as corn and the yield per acre is about the same as corn.

When harvesting sorghum for silage follow the same rule as for corn -- the seed should be in the late milk or early dough stage to make the best quality of silage. When mixed with corn or late harvested legumes, it may be harvested earlier. When used alone, the quality of the silage will be entirely satisfactory if the sorghum has reached the early dough stage.

When Mixing Corn and Sorghum for Silage

Sorghum may be mixed with satisfactory results with corn in the silo in any proportion desired. A common mixture is one load of sorghum to one of corn but the mixture may be any proportion ranging from practically all corn to practically all sorghum. Straight sorghum silage is entirely satisfactory.

May Mix Sorghum with Late Harvested Legumes

Recent experiments show that sweet sorghum makes a very satisfactory silage when mixed with such legumes as soybeans or a late harvesting of alfalfa. When so used, the sorghum substitutes satisfactorily for molasses or ground corn and the quality of the silage -- if a proper mixture is used -- is decidedly good. While a mixture consisting of half sorghum and half legume (soybeans or alfalfa) appears to be most ideal, yet a mixture of one part of sorghum to two parts of legume will also provide good quality silage. If the mixture is fifty-fifty, and the silo is 14 feet or more in diameter, filling the silo by use of alternate loads is all right. If the mixture is one of sorghum to two of the legume, then it is best to mix the two with reasonable evenness at the silage cutter.

Sorghum for Sirup

A sugar shortage always arouses interest in sorghum sirup, and while there is no question about sorghum being an exceptionally good food and satisfac-

tory in many ways as a substitute for sugar, yet the expectations of its usefulness are not usually realized.

Those who are within hauling distance of a sorghum mill which is already in successful operation will do well to produce as much sorghum as the mill will accept. On the other hand, those who do not have a sorghum mill in the community would be unwise to undertake producing sorghum sirup. Home devised or makeshift equipment is seldom satisfactory nor would it be wise to establish additional sorghum mills.

Yield of sirup. A yield of 75 to 80 gallons of sirup per acre may be expected from a good crop of sorghum. When grown for sirup the stand should not be very thick. Three or four stalks to the hill, with the hills a foot and a half to two feet apart in the row is suggested, or if the sorghum is drilled then the plants should be from six to eight inches apart. If check rowed the number of plants per hill may be from four to five.

What Time to Harvest for Sirup

To make good quality of sirup the sorghum should be harvested when the seeds are approximately ripe, say fully in the dough stage. It is also important that harvesting should be done before a killing freeze or in the event that a severe freeze occurs then the crop should be harvested immediately afterwards. If the leaves are stripped off the damage by a freeze is considerably lessened.

The leaves should be stripped by hand while the stalks are still standing and the heads should be removed either before cutting the stalks or after they are bundled and before they are taken to the mill. It is necessary to tie the stripped and headed stalks into bundles in order to handle satisfactorily.

The grain of sweet sorghum, if properly cured, is satisfactory as feed for almost any kind of livestock, being worth from 60 to 90 percent as much as shelled corn. It is quite commonly used for feeding poultry. The recommendations of poultry specialists should be followed as to the proportion of sorghum grain to use in any feed mixture. For detailed information on the manufacturing of sorghum sirup write to the College of Agriculture, Madison, Wisconsin for U.S.D.A. Farmers Bulletin No. 1791.

HAY HARVESTING CALENDAR

Crop	1st Cutting	2nd Cutting	Remarks
Alfalfa	Cut about June 25	Cut at about half bloom. Avoid letting hay get so dry and mature that the leaves will shatter.	Avoid cutting in September, since winter killing may result.
Red Clover Alsike clover and mixed hay	Cut when in full bloom and a few blossoms are turning brown.	Second cutting of June clover often left for seed crop. Cut for seed when heads are brown and seeds have hardened.	If cutting second crop for seed, try to get first crop off rather early. Alsike and mammoth clover seed in first cutting. Usually no second cutting.
Emergency Hay Crops:			
Sudan grass	Starting to head out.	Starting to head out.	Consult your County Agent
Soybeans	Beans about half grown in pods, lower leaves still green.		
Oats & Vetch	Oats in late milk stage.		
Oats & Peas	Oats in late milk stage.		

Reference: "Farm Crops Department" - Michigan State College

SEED TREATMENT RECOMMENDATIONS

Crop	Diseases Controlled	Treatment Material	Method of Treatment	Remarks
Corn	Seedling Diseases Root rots	New Improved Semesan, Jr. Merko Barbak C or D Arasan	Follow manufacturers instructions as to amount of dust to apply. Use seed treating machine and thoroughly cover seed with dust.	Hybrid seed corn sold in Wisconsin under tag has been treated. Local seed should be treated as an assurance of good stand when soil is cold and damp.
Oats	Smuts	Ceresan	Follow manufacturers instructions on amount of dust to apply. Use treating machine or Minnesota treater.	New varieties of oats resistant to smut such as Vicland have been distributed in the state. Seed treatment is less essential for such varieties and is advised when seed lots are somewhat weathered or damaged from storing when moisture is high.
Barley	Covered Smut Blackloose Smut Seedling blight Stripe	Ceresan	Follow manufacturers instructions on amount of dust to apply. Use treating machine or Minnesota treater.	Wisconsin Barbless (Wis. Ped.38) should be treated when the two smuts are present in the seed field. Wisconsin Barbless is resistant to stripe disease. The true loose smut can be controlled only by the hot water treatment when this smut is prevalent at the time barley is heading. It is advisable to get certified seed.
Wheat	Bunt or Stinking Smut Seedling blight.	Ceresan	Follow manufacturers instructions on amt. to apply. Use treating machine or Minnesota treater.	Seedling stands are generally improved by seed treatment. Bunt is usually not severe.
Potatoes	Black Scurf Common Scab Black Leg	Corrosive Sublimate Semesan Bell	Use 4 oz. corrosive sublimate with 30 gal. of water for every 10 bu. of potatoes. Treat in wood or stone container 1½ hours. Soak. Use Semesan Bell according to mfgs. instructions.	On old potato soils seed treatment frequently does not control scab or crop. Use clean seed stocks to prevent introducing bacterial ring rot and virus diseases.
Beans Peas Sugar-beets	Consult Experiment Station Plant Disease Specialist and Circulars			
Alfalfa Clover Soy-beans	Inoculate seed with proper bacterial cultures unless crop has been grown recently on the land. Cultures can be obtained from Agr. Exp. Sta., Madison, Wis.			

Reference: Wis. Stencil Cir. 128 - "Grain Seed Treatment"- Rev. Mar., 1941

INSECTS ATTACKING CROPS

Name	Where Found	When	Control
Weevil	Stored grain	Year round	Propylene or Ethylene dichloride mixture, 2 lbs., to 100 cu. ft. of space. Use at 70° F.
Hessian Fly	Wheat, barley	Fall, spring	Observe fly-free seeding dates.
Corn Borer	All corn	July 10-Sept.	Use corn for silo or shred. Burn stalks or plow under before June 15.
White grubs	Roots of grass, potatoes, corn	Live 2-3 yrs. in soil	Adults are May beetles. Crop rotation with clover.
Cut worms	Corn, vegetables	May	Poison bait: 5 lbs. bran; ¼ lb. Paris green; 1 pt. syrup; 2 grd. oranges or lemons; 3 qts. water. Scatter where insects frequent (enough for ½ acre). Fall or winter plowing.
Grasshoppers	Meadows	Summer	Poison bait
Sod web worm	Corn	May	Replant. Cultivate often close to row. Fall or winter plowing.
Beetles (various)	Potatoes, cucumbers, radishes, etc.	Summer	Spray or dust with Calcium Arsenate.
Potato leafhoppers	Alfalfa	July	Timely cutting -- early bloom stage. Usually about June 25.

Reference: U.S.D.A. - "Control of Insects on Hay Crop Seeds"

A. Chemical Weed Control

USE SODIUM CHLORATE on small patches of perennials according to the following directions:

1. For summer use on thistles and poison ivy, dissolve 1 pound in 1 gallon of water and apply as a spray;

2. For all other weeds, apply as the dry salt in the fall of the year;

3. Apply uniformly the proper amount to every square rod;

4. Apply the chemical 5 to 6 feet beyond the last visible plants in the patch;

5. Prevent all clothes, wood or any other combustible materials from becoming contaminated with sodium chlorate, and in case contamination occurs, thoroughly wash out all chlorate before allowing such materials to dry out. All dry combustible materials impregnated with sodium chlorate present a fire hazard.

Canada Thistle and Perennial Sow Thistle

Apply two pounds per square rod as a spray solution when the plants are just beginning to bud. Spray all recovering plants at 3 to 4 week intervals. For fall treatment, apply four pounds per square rod to Canada Thistle between September 1st and October 1st and the same amount for sow thistles between October 1st and October 30th.

Poison Ivy

Apply 2 to 3 pounds of Sodium Chlorate per square rod as a spray solution in July or August. Thoroughly wet all leaves on both sides. Repeat if necessary and re-treat all recovering plants in July or August of the following year. Note: A new chemical recommended only for poison ivy is Ammonium Sulfamate. Use this chemical according to the directions which come with the chemical.

Field Bindweed or "Creeping Jenny"

Apply 4 pounds of Sodium Chlorate per square rod in September or October. Re-treat recovering plants individually late in the summer of the following year.

Leafy Spurge

Same as above except use 6 to 8 pounds per square rod.

Quack Grass

Make applications from late October until the ground is frozen. Apply 1 to 1½ pounds per square rod in crop fields and follow this

with a cultivated crop the next year. For non-cultivated and waste areas, apply 2 to 3 pounds per square rod.

Wild Mustard

Use shallow surface cultivations in early spring and late fall to induce seed germination. Infested areas seeded to grain should be sprayed with "Sinox". This chemical is practicable and profitable. Further details available from the Wisconsin Experiment Station, Madison.

B. Cultivation and Smother Crops

FIELD BINDWEED AND LEAFY SPURGE: Use the field cultivator equipped with sharp duckfoot shovels and cultivate about 4 inches deep at 10 to 14 day intervals from early spring to fall and seed winter rye. Pasture the rye or plow it under in the spring and continue cultivations until late June when soybeans or Sudan grass should be seeded heavily and later cut for hay. Cultivate and again seed to rye and repeat the second year's program the third year. With Field Bindweed, the cultivation may start after the removal of an early crop of canning peas. In this case, cultivate throughout the entire second season and seed a smother crop in June of the third year or use a clean cultivated crop.

Canada Thistle and Perennial Sow Thistle

Infested areas suited to the growth of alfalfa should be properly limed and fertilized and then seeded to alfalfa for 4 to 5 years. It is highly desirable that 2 to 3 months of thorough cultivation, as described for Bindweed, be given the infested areas during the months of July, August or September of the year preceding the sowing of alfalfa. The programs recommended for Bindweed and Leafy Spurge may also be used for these weeds.

Quack Grass

Use the field cultivator equipped with springtooth shovels and cultivate at 8 to 10 day intervals throughout an entire season. Begin cultivation after early hay or grain crop. Seed winter rye and proceed the second year as recommended for field bindweed using a smother crop or seed to checked corn.

Dodder, White Cockle and Hoary Alyssum

These weeds are most troublesome in hay and clover fields. They can be brought under control by: (1) Sowing only weed-free seed; (2) Prevent seed setting which may mean hand-pulling scattered plants or prematurely cutting entire badly infested fields and following with shallow plowing and cultivation; (3) Placing infested fields in checked corn and supplementing with hand hoeing to prevent seed setting.

Reference: Wis. Stencil Circular 217 - "Control Field Bindweed"

WISCONSIN CROP VARIETIES AND PLANTING CHART

Crop		Wt. per bu.	Planting Time			Seed Used Per Acre	Recommended Varieties			Remarks
			S & SW Wis.	Cent & East	Northern Wis.		S & SW Wis.	Cent & East Wis.	Northern Wis.	
CORN	Grain	56	5/1 to 6/1	5/10 to 6/10	5/20 to 6/20	6-8″ S&SW 7-9″ C&E 8-12″ N	Hybrids(100-110) Gold. Glow	Hybrids(95-100) Med. Gold Glow; Minn. 13	Hybrids(80-95) Wis. 25; Minn. 13	*Wis.255(80-day) *Wis.335(90-day)
	Silage	56	5/1 to 6/20	5/10 to 6/15	5/25 to 7/1	7-9″ S&SW 8-19″ C&E 8-14″ N	Hybrids(115-125)	Hybrids(110-120) Gold. Glow;	Hybrids(85-95) Wis. 25; Minn 13; Med Gold Glow	*Wis.275(85-day) *Wis.335(90-day)
	Pop		5/1 to 6/1	5/10 to 6/10	5/20 to 6/20	8-12″	Minn. Hybrids; Jap Hulless; South American	Minn. Hybrids; Jap Hulless; South American	Minn. Hybrids; Jap Hulless	
	Sweet		5/1 to 6/1	5/10 to 6/10	5/20 to 6/20	8-12″	Purdue Hybrids; Minn. Hybrids; Golden Bantam; Evergreen	Purdue Golden Cross Bantam; Minn. Hybrids; Golden Bantam	Golden Cross Bantam; Minn. Hybrids; Golden Bantam	
BARLEY		48	4/1 to 4/25	4/5 to 5/1	4/15 to 5/5	1½-2 bu.	#38; Oderbrucker #5	#38; Oderbrucker #5	#38; Oderbrucker #5	Not recommended on poor or sandy soils.
WINTER RYE		56	9/1 to 10/1	9/1 to 9/25	8/24 to 9/20	1½ bu.	Imperial #6 #12.19	Imperial #6; #12.19	Imperial #6; #12.19	Imperial white or light color
WHEAT	Spring	60	4/1 to 4/25	4/5 to 5/1	4/15 to 5/5	1½ bu.	Sturgeon	Sturgeon	Sturgeon	
	Winter	60	9/10 to 10/1	9/1 to 9/25	8/24 to 9/20	1½ bu.	#2; Ashkof; Minturki	#2; Ashkof; Minturki	#2; Ashkof; Minturki	
OATS		32	4/1 to 4/25	4/5 to 5/1	4/15 to 5/5	2-2½ bu. reduce to 1-2 bu.as nurse crop	Early-Vicland; States Pride; Gopher Medium-Forward Spooner; Wis. Wonder	Early-Vicland; States Pride; Gopher Medium-Forward Spooner; Wis. Wonder	Early-Vicland; States Pride; Gopher Medium-Forward Spooner; Wis. Wonder	Resistant to smuts and rusts.

*Recommended for Northern Wisconsin

WISCONSIN CROP VARIETIES AND PLANTING CHART

Crop	Wt. per bu.	Planting Time			Seed Used Per Acre	Recommended Varieties			Remarks
		S & SW Wis.	Cent & East	Northern Wis.		S & SW Wis.	Cent & East Wis.	Northern Wis.	
HEMP	44	4/25 to 5/10	5/1 to 5/15		4-6 pk.	Kentucky	Kentucky for Eastern part of State.		Dark prairie silt loam soils are needed; not suitable for peet, marsh, sandy, gravelly or dry soils.
CLOVER									
Alsike	60	4/1 to 4/20	4/10 to 4/25	4/15 to 4/30	8# alone 4# in mix				
White	60	4/1 to 4/20	4/10 to 4/25	4/15 to 4/30	4-6# alone 1-3# in mix	Sometimes planted on frozen ground in spring			
Medium*	60	4/1 to 4/20	4/10 to 4/25	4/15 to 4/30	10-12# alone 6-8# in mix	Adapted seed	Adapted seed	Adapted seed	*Mam. Cl may be substituted under some conditions.
Sweet	60	4/1 to 4/20	4/10 to 4/25	4/15 to 4/30	12-15# alone 8-12# mix	White Blossom; Yellow Blossom	White Blossom; Yellow Blossom	White Blossom; Yellow Blossom	Y Blossom 10 days earlier than white.
ALFALFA	60	4/1 to 4/20	4/10 to 4/25	4/15 to 4/30	10# alone 8# mix	Ladak; Cossack; Grimm; Canadian Variegated	Ladak; Cossack; Grimm; Canadian Variegated	Ladak; Cossack; Grimm; Canadian Variegated	Hardy strains northern grown seed. Ladak and Cossack mixture where Alf. Wilt is prevalent.
HAY & PASTURE MIXTURES (New seeding)		4/1 to 4/20	4/10 to 4/25	4/15 to 4/30	8# Red Clover with 4 to 6# Timothy or 6-8# Alsike with 4 to 6# Timothy or 5# Red Clover with 3 to 5# Alsike and 4 to 6# Timothy or 8 to 10# Alfalfa with 6 to 10# Brome Grass or 10# Alfalfa with 4# Timothy.				

WISCONSIN CROP VARIETIES AND PLANTING CHART

Crop	Wt. per bu.	Planting Time: S & SW Wis.	Planting Time: Cent & East	Planting Time: Northern Wis.	Seed Used Per Acre	Recommended Varieties: S & SW Wis.	Recommended Varieties: Cent & East Wis.	Recommended Varieties: Northern Wis.	Remarks
PASTURE RENOVATION MIXTURES					*10# Alfalfa with 5# Red Clover and 3 to 4# Timothy **10# Swt Clover with 5# Red Clover and 3 to 4# Timothy *** 5# Timothy, 7# Kent. Blue Grass, 3# Alsike, 2# White Clover seeding and 3# Red Clover.				*Use on good soil **Use on poorer soil ***Use only when seeding cult. land to perm. grass.
POTATOES									
Early	60	4/20 to 5/15	4/20 to 5/15	4/20 to 5/20	10-15 bu. S & Cent.	Irish Cobbler; Early Ohio	Irish Cobbler; some Triumph on muck.	Irish Cobbler; Triumph	*Adapted to both early and late growing season. **Seed Crop planted 5/25 to 6/25
Medium	60	Same as late			15-25 bu.	*Chippewa	*Chippewa	*Chippewa	
Late	60	5/20 to 6/15	5/25 to 6/20	5/20 to 6/15**	Northern (Check row loss)	Rural New Yorker Group; Sebago	Rural New Yorker Group; Katahdin; Sebago	Rural New Yorker Group; Katahdin; Green Mountain; Sebago.	
BUCKWHEAT	50	6/1 to 7/1	6/1 to 7/1	6/10 to 7/10	48-60#	Silver Hull; Japanese	Silver Hull; Japanese	Silver Hull	
MILLET	50	5/20 to 6/20	5/20 to 7/1	6/1 to 7/1	30-40#	*Japanese; German; Hungarian; Common; **Proso	*Japanese; German; Hungarian; Common; **Proso	German; Common; Hungarian; **Proso	*For low land. **For seed or grain.
TIMOTHY	45	4/1 to 4/20	4/10 to 4/25	4/15 to 4/30	6-12# alone 4-6# mix	Timothy sometimes planted in the fall from Aug. 15 to Sept. 10 and also on the frozen ground in the spring.			
CANARY GRASS		Early spring or late fall.			6-8#				Suitable for lowlands.

WISCONSIN CROP VARIETIES AND PLANTING CHART

Crop	Wt. per bu.	Planting Time			Seed Used Per Acre	Recommended Varieties			Remarks
		S & SW Wis.	Cent & East	Northern Wis.		S & SW Wis.	Cent & East Wis.	Northern Wis.	
SUDAN GRASS	32	5/20 to 6/20	5/20 to 6/20	6/1 to 7/1	30-40#			Grown only where 105-day corn matures.	Grow only on more fertile soils.
PEAS									
Field	60	4/1 to 5/1	4/10 to 5/10	5/1 to 5/20	1-2 bu.* 2-4 bu.**	Canadian Yellow Scotch; Green	Canadian Yellow Scotch; Green	Canadian Yellow Scotch; Green	*With 1½ bu. oats for Emer. hay or hog pasture. **For seed.
Canning		*	*	*	*	*	*	*	*Follow rec. of Canning Comp.
SOYBEANS									
Hay	60	5/20 to 6/20	5/25 to 6/20	6/1 to 6/20	45-60#* 90-120#**	Manchu #3; Illini; #606 Mukden	Manchu #3*; Illini; Mukden #606	Wis.Early Black Manchu; #606; #3	*In rows **Solid drill
Grain	60	5/15 to 6/1	5/20 to 6/1	5/30 to 6/1	45-60# 90-120#	Manchu #3, Mukden Manchu 606	Manchu #3; Mandarin; Manchu 606	Manchu 606; Mandarin	
FIELD BEANS	60	5/15 to 6/1	5/20 to 6/10	5/30 to 6/20	30#	Navy	Navy	Navy	
RAPE*		4/1	to	7/1	Drilled 4# acre broadcast 6-7# acre, or drill oats 1½ bu. acre and broadcast 5-7# rape or broadcast 5.7# rape with 1 bu. each oats and peas drilled.				*For hog pasture.

Reference: College of Agriculture, University of Wisconsin

WAYS TO REDUCE POTATO SCAB & BLACK SCURF

The potato diseases scab and black scurf are fungus troubles that cause serious losses to Wisconsin producers. Seed treatment is one phase of control. The object is to kill the disease germs on the surface of the tubers. However, seed treatment frequently does not give desired results since the fungus germs may be present in the soil and thus cause infection of the crops. The control program should include the following:

I. The first point in the control program is to select disease-free seed. Any potatoes that have deep scab or prominent black scurf on the surface should be rejected for seed purposes. The selection of clean seed can readily be done by the grower himself with practically no cost and a little expenditure of time. Remove the diseased tubers from the seed stock.

II. The disease content of the soil is the next point to consider. Any field on the farm that has produced crops of potatoes badly infected with scab or black scurf should not be considered as far as potatoes are concerned. The soils to be avoided for potatoes include those freshly limed, freshly manured with horse manure, sheep manure or chicken droppings, or old soils poor in humus, and pasture soils where horses and sheep have been kept.

The cleanest crops of potatoes are usually grown in rather highly acid soils having a good supply of humus and those that have not been exhausted of their natural fertility.

III. Use scab-resistant varieties such as Russel Rural when the soil has shown a tendency to produce a scabby crop. Among the early varieties, the Triumph and Irish Cobbler are very susceptible to scab. In the late crop varieties the Green Mountain and Katahdin are very susceptible. The smooth Rural shows medium susceptibility. The smooth Rural shows medium susceptibility.

IV. Many growers have received so little benefit from seed treatment when good seed is used that they have discarded this procedure. Its value in many cases is questionable. If you have not been in the habit of treating your seed, try one of the methods listed on the attached sheet on part of your crop.

A. Treat dormant seed. The smaller the sprout the less likelihood of injury. Dormant eyes are very resistant to any treatment. Organic mercury or formaldehyde compounds are less injurious than hot solutions or acid mercury dips.

B. Dry tubers with good air circulation at once after treatment. This checks the action of the treatment on the developing sprouts and reduces injury.

C. Protect treated seed from hot sun or frost by having the treating done in a shed or on a barn floor. This will prevent lowered vitality and loss of ability to sprout. Pile in layer not over 4-5 inches deep or handle in slatted crates set so that air can circulate freely around them.

D. Treat potatoes a week or ten days before planting. This allows time for cutting the seed and gives a chance for a short healthy sprout to form before seed is put in the ground.

E. Treat uncut seed. If cut seed is treated, it is likely to give poorer germination because of greater seed injury. Furthermore, the strength of treating solution is more rapidly reduced by the cut seed surface than unbroken outer skin. Short dips with organic mercury are less injurious than longer treatments.

F. Obtain treating chemicals from your local seed house or drug store. The College of Agriculture does not handle any potato treating material.

Using the Different Treatments

I. Cold corrosive sublimate. This treatment has been widely used for the last 25 to 30 years. It will control the surface-borne germs of scab, black scurf and black leg. The latter is only rarely a serious problem in Wisconsin. Select a wooden barrel, or tank of wood or concrete as this chemical corrodes iron. Proceed as follows:

A. Weigh out one ounce of corrosive sublimate to each 7½ gallons of water. For an ordinary barrel use 3 ounces and 22½ gallons.

B. Dissolve the corrosive sublimate in a quart or more of hot water in a glass jar or stone crock. Salt in the water aids solution.

C. Measure the water into the treating barrel or tank and add the dissolved corrosive sublimate. Stir well.

D. Handle the potatoes to be treated loose or in wooden crates. Wire baskets may be used after covering the metal with asphaltum paint.

E. Time of treatment

Method A.

Treat the first lot 1½ hours, the second 1-3/4 hours, the third 2 hours. Then throw away the solution. The added time following the first treatment usually takes care of the loss in strength of the solution. The above method is generally favored by the smaller growers.

Method B.

Treat each lot 1½ hours. Following each treatment add ½ oz. of corrosive sublimate for each 4 bu. treated in order to restore solution to original strength. Add water to bring solution up to original volume. This method will serve for a day's run.

F. Corrosive sublimate is a poison if taken internally. If accidentally swallowed, give an emetic and call a doctor at once. Keep it away from small children and farm animals.

II. Acid Mercury Dip. The acid mercury dip has for several years been gaining in popularity over the cold corrosive sublimate treatment. It required less time and labor and where seed is dormant causes little injury to the germination. Proceed as follows:

A. Use 6 ounces corrosive sublimate to 1 quart of commercial hydrochloric acid in a glass jar, jug or stone crock. It will dissolve at once. This is a stock solution.

B. Measure out 25 gallons of water in a 50 gallon wooden or concrete tank.

C. Pour acid mercury stock solution into the water; stir thoroughly.

D. Put in potatoes handled loose or in wooden crates. Wire baskets may be used if thoroughly painted with asphaltum paint.

E. Time of treatment is 5 to 10 minutes. If there is much scab or black scurf present a soaking of 20 minutes is suggested.

F. Treat 40 to 50 bushels of potatoes in the 25 gallons of acid dip solution. To bring the solution back to approximately its original strength add ½ pint of stock solution as in "A" and enough water to make up the original volume of 25 gallons. After a second lot of 40 to 50 bu. of potatoes has been treated, the solution should be discarded.

G. Dry tubers at once after treatment. This should be done away from direct sunlight or farm animals. A shed or barn floor is desirable where cross ventilation is available.

H. Plant treated tubers in about a week or ten days. This allows inspection for strong eyes before planting. Tubers cut and planted at once will be slower in germination than those allowed to green sprout in the air.

I. Wash treated potatoes whenever drying conditions are so poor at the time of treatment that free moisture remains on the surface for longer than ½ hour.

J. Corrosive sublimate and hydrochloric acid are both very poisonous and should be handled carefully. The dilute solution will not injure the skin.

III. Formaldehyde. Formaldehyde as a potato seed treating chemical has been losing in popularity in recent years because (a) the cold treatment of 2 hrs. with 1 lb. to 30 gal. of water took so much time and (b) the hot solution, 1 lb. to 15 gal. of water at 124°-126° F. for 3, not over 4 minutes, was likely to be followed by poor stand and consequent smaller yield. Complete directions will be furnished upon request.

IV. Patented mercury compounds. Semesan Bell and Corona PD7 have been on the market for some time. Yellow oxide of mercury is of recent introduction Less consistent results have been secured under Wisconsin conditions with these materials than with cold corrosive sublimate or acid dip. However, they have several points in their favor, i.e., they are simple to use, the time of treatment is short--usually 1 minute, there is very little injury to germination, no depression of yield, they do not corrode metals, they do not lose strength on standing and there is no bother with critical temperatures. Detailed directions are supplied by the manufacturing chemists. Your county agent will gladly secure the information for you.

Reference: Wis. Stencil Cir. 172 - "Ways to Reduce Potato Scab & Black Scurf" - Rev. Feb., 1940

SPRAY OR DUST TO CONTROL INSECTS AND DISEASE

Three insects, Colorado potato beetle, (potato bug) flea beetle, potato leaf hopper and two diseases, early and late blight, which can be controlled by proper spraying or dusting, are likely to damage potatoes during the growing season. These pests make it necessary to follow carefully an effective control program. Proper materials must be applied when they are most effective, depending on the season and appearance of these pests.

Control Flea Beetle, Potato Beetle and Leaf Hopper

Flea beetles, (small, shiny, black beetles, slightly larger than a pin head) usually appear in large numbers soon after the plants emerge and eat small round holes in the leaves.

The well known, hard-shelled potato beetles or "bugs" appear about the same time and lay masses of orange-colored eggs on the under sides of the leaves. In warm weather these eggs soon hatch into colonies of young larvae (bugs) which soon crawl to all parts of the plants and rapidly eat off the leaves.

The potato leaf hoppers also appear early in the season. The adults -- small, green, winged insects -- lay their eggs along the veins of the under sides of the leaves. These eggs hatch into small green "nymphs" that go through two or three moults before reaching the adult stage. These nymphs in all their stages as well as the adult hopper suck the leaf juices finally causing a type of marginal burn and upward rolling of the leaves known as "hopper burn".

The most general control measure for the flea beetle, Colorado potato beetle and leaf hopper is to spray thoroughly with bordeaux mixture to which is added an arsenical poison (usually calcium arsenate) at the rate of $2\frac{1}{2}$ pounds for each 50 gallons of spray. In this combined spray, applied under high pressure, the calcium arsenate poisons the leaf-eating bugs and beetles and the bordeaux mixture acts as a repellant in control of the leaf hopper.

Although more specialized growers favor the liquid spray, dust may also be used effectively. Copper-lime dusts and other brands can be obtained both with or without the poison. Improved hand dusting equipment is available for small plantings. Best results will be obtained if dusting is done when there is little wind and while the plants are moist with dew.

Control Early and Late Blight

Early blight usually appears shortly after mid-season, and produces dark circular rings or irregular spots on the leaves. Late blight, the disease associated with brown rot on tubers, is most likely to occur during cool, foggy wet periods during the late season (Aug. 20 to Sept. 15). In advanced states during epidemics of late blight the under surface of the leaves may become covered with a conspicuous mildew. Millions of spores or seeds of the disease are set free to be washed into the soil in wet weather and later to cause rot in the tubers.

Early and late blight are controlled by spraying thoroughly with bordeaux mixture under high pressure. This is prepared by using:

Copper sulfate (Blue Vitriol)	8 pounds
Lime (Hydrated)	10 pounds
Water	100 gallons

Growers now use a lime especially prepared by manufacturers for spraying. Most growers use instant dissolving copper sulfate or finely ground crystals (blue stone) that go into the solution quickly. Bordeaux mixture can be prepared by forcing the mixed lime and copper solution by water pressure directly through a very fine mesh trainer into the sprayer. Stock solutions of both copper sulfate and lime are usually prepared. Calcium arsenate powder is mixed to thin paste and then washed through strainer into the sprayer usually at rate of $2\frac{1}{2}$ pounds to 50 gallons of spray.

Reference: Wis. Circular 325 - "Potato Growing in Wisconsin" - Mar., 1942

SECTION V - FRUITS

SMALL FRUIT PLANTING PLAN FOR WISCONSIN FARMS

(Planned to supply a family of 4 to 6 persons for a year)

RASPBERRIES				STRAWBERRIES RHUBARB, & ASPARAGUS	No. of Plants	GRAPES						CURRANTS AND GOOSEBERRIES	No. of Plants
Red	No. of Plants	Black	No. of Plants			Blue	No. of Plants	Red	No. of Plants	White	No. of Plants		
Chief or June	50	Logan or Quillen	25	Strawberries		Fredonia	2	Brighton	2	Portland	2	RED Currants	
Latham	50			Premier Beaver or Senator Dunlap	100	Moore's Early	2	Delaware	2			Red Lake or Wilder	4 - 6
		Purple				Worden	2						
		Royal	25	2½-3 ft. between plants; rows 3½-4 ft. apart		Concord	2					Gooseberries	
						Beta	2					Poorman or Downing or Industry	2 2 2
Red raspberries should be planted 1-1/2 ft. apart in the row with 6 feet between the rows. Black and Purple need more room. Plant them 4 to 5 feet between hills and 7 feet between the rows.				Rhubarb		Grapes should be planted 8 ft. apart each way and dug in for the winter.						Plant Currants and Gooseberries 5-6 feet apart each way with Asparagus and Rhubarb.	
				Red McDonald	10								
				Asparagus Mary Washington	50								

A SUGGESTED FARM ORCHARD PLANTING FOR NORTHERN WISCONSIN

APPLES

Variety	Use	Season	No. Trees
FOR SUMMER			
Melba	e-s	Aug.-Sept	1
Duchess	c	Sept.	1
Dudley	b-c-e	Sept.	1
Milton	b-c-e -s	Sept.	1
FOR FALL AND EARLY WINTER			
Wealthy	c-e-s	Sept.-Dec.	2
McIntosh	b-c-e -s	Sept.-Feb.	2
FOR LATE WINTER & EARLY SPRING			
NW Greening	b-c	Nov.-Apr.	2
Haralson	c	Jan.-Apr.	2
OTHERS FOR TRIAL ONLY (In favored locations)			
Cortland	b-c-e -s	Oct.-Feb.	2
Prairie Spy	b-c-e	Nov.-Feb.	2
Minjon	c-e	Oct.-Jan.	2
Goldo (Yellow)	c-e	Nov.-Jan.	1
Minn. 790	b-c	Oct.-Jan.	1
Malinda	c-e	Dec.-May	1
CRABS			
Dolgo	j	Aug.	1
Whitney	c-e	Sept.	1
SweetRusset	p	Sept.	1
Hyslop	c-j	Sept.-Oct	1

PLUMS

Variety	Use	Season	No. Trees
RED PLUMS			
Underwood	e-j		
Toka	c-e-j		
Monitor	e-j		
Ember	e-j		
Pollenizers-Goff & Surprise			1

PEARS

Variety	Use	Season	No. Trees
Patten	c-e	Sept.	1
Lincoln	c-e	Sept.	1
Parker	c-e	Oct.	1
Flemish-Beauty	p-e	Oct.	1

CHERRIES

Variety	Use	Season	No. Trees
Oka			3-4
Sapa			1
Montmorency			3-4

LEGEND: b-baking; c-sauce and pie or canning; e-eating; j-jam; p-pickling; s-salads.

NOTES: Trees to be planted 30-35 ft. apart on the square, 15 to 20 ft. from the fence. Cherry, plum and pear trees on west side of orchard to obtain wind protection from windbreak of white cedar, Norway spruce, white pine or a combination of all. Windbreak should be to west and southwest of the orchard.

The home orchard should be near to the home and to the west of it if possible. North, northeast, East and southeast slopes are to be preferred. To insure good air drainage and less hazard of late spring frost damage, plant the orchard on higher elevations on a favorable slope with unobstructed air drainage to lower land.

This plan has been devised to produce a year's supply for a family of 4 to 6 persons and a small surplus for local market.

A SUGGESTED FARM ORCHARD PLANTING FOR SOUTHERN WISCONSIN

APPLES

Variety	Use	Season	No. Trees
FOR SUMMER			
E.Red Bird	c	July-Aug.	1
Melba	c-s	Aug.	1
Dudley	b-c-e	Aug.	1
Duchess	c	Aug.	1
Milton	b-c-e-s	Sept.	1
FOR FALL AND EARLY WINTER			
Wealthy	c-e-s	Sept.-Nov.	1-2
McIntosh	b-c-e-s	Sept.-Jan.	2-3
Cortland	b-c-e-s	" "	1-2
Snow	c-s	Oct.-Dec.	1
FOR LATE WINTER & EARLY SPRING			
N.W.Green-ing	c-b	Nov.-Apr.	1
Macoun	c-e-s	Nov.-Feb.	2
G.Delicious	e-s	Nov.-Feb.	1
Delicious	e-s	Nov.-Mar.	2
Perkins	c-s	Dec.-Apr.	2
Red Spy	b-c-e-s	Dec.-Apr.	2
Secor	c-e-s	Dec.-Apr.	2
OTHERS FOR TRIAL ONLY			
Crab apples for:			
Dolgo	jelly	Aug.-Sept.	1
Whitney	c-e	" "	1
Hyslop	e-j	Sept.-Oct.	1

PLUMS

Variety	Use	Season	No. Trees
RED PLUMS			
Underwood	e-j	Aug.	1
Toka	c-e-j-s	Sept.	1
Monitor	c-j	Sept.	1
Ember	c-j	Sept.	1
Pollenizers:			
Goff or Surprise	c-j	Sept.	1
BLUE PLUMS			
Lombard	e-c	Sept.	1
Ital.Prune	e-c	Sept.	1
Stanley	e-c	Sept.	1

PEARS

Variety	Use	Season	No. Trees
Clapp's	c-e-s	Sept.	1
Bartlett	c-e-s	Sept.	2
Tl.Beauty	e-c	Oct.	1
Seckel	c-p	Oct.	1
Lawrence	e-s	Nov.-Dec	1
Parker	e-c	Oct.-Dec	1
Winter Nelis	c-p	Dec.-Feb	1

CHERRIES

Variety	Use	Season	No. Trees
Early Richmond	e-c	July	2
Mont-morency	e-c	Aug.	2

A few Russian Mulberries near the cherries for the birds.

LEGEND: b-baking; c-sauce and pie or canning; e-eating; j-jam; p-pickling; s-salads

NOTES: Trees to be planted 30-35 ft. apart on the square, 15 to 20 ft. from the fence. Cherry, plum, and pear trees on west side of orchard to obtain wind protection from windbreak of white cedar, Norway spruce, white pine or a combination of all. Windbreak should be to west and southwest of the orchard.

The home orchard should be near to the home and to the west of it if possible. North, northeast, east, and southeast, slopes are to be preferred. To insure good air drainage and less hazard of late spring frost damage, plant the orchard on higher elevations on a favorable slope with unobstructed air drainage to lower land.

This plan has been devised to produce a year's supply for a family of 4 to 6 persons and a small surplus for local market.

POINTERS ON THE CARE OF SMALL FRUITS

Strawberries

When the strawberry crop has been harvested, canned, frozen, sold, or used, it is time to renovate the patch. If properly done, it will do away with the weeds and re-establish new rows of strong plants for the next or second year's crop. It also serves as a good check on insect and disease pests which may be about to become troublesome.

The methods of renovation vary even with the best strawberry growers. The most common practice is to:

1. Remove the mulch from the patch immediately after the last picking.

2. Mow the tops with a scythe or mower.

3. When the mowed tops are dry, either burn them or plow them under. (This is a good insect control practice.)

4. Narrow each row, by plow, disk, or cultivator, so that a width of only 6 to 10 inches of plants remain alongside one edge of each row. (It is best to do this soon after a soaking rain.)

5. Thin the plants in these narrow rows, leaving only the best ones. Remove the weeds at the same time.

6. Cultivate frequently to induce development of new plants that will be strong by fall, but keep the rows from running together. Cut the runners.

7. Mulch the patch with 3 inches of marsh hay or weed-clean straw just ahead of the first hard freeze in late October or early November.

Raspberries

The raspberry harvest is on during the latter part of June if you have the early varieties June or Chief. The picking of the June red raspberry in the University patch starts about June 20 and will continue until Latham is at its best. For home use, pick "eating ripe", whether they are to be canned, frozen, or eaten fresh. Each picking should be thorough and the berries should be dry and cool when picked. It is advisable to pick them into shallow containers, pint boxes. Quart boxes are too deep for raspberries.

Raspberry Cane Borer

While the harvest is on, it is easy to find the wilted tips on the new canes. These are infested with the raspberry cane borer. By breaking off the wilted tips and destroying them once a week, it is possible to eliminate the pest from the plantation.

Remove Old Canes

As soon as the harvest is over, the old canes which produced the berries should be cut off and removed from the patch and burned. This does away

with disease and insect infestation in them and gives the young canes a better chance for sunlight and air circulation, both of which are an excellent help in checking the development of fungus diseases such as anthracnose.

Avoid Deep Cultivation

Cultivation should be frequent enough to keep weeds out and should be shallow, especially near the plants, or damage will result to the roots. Rows should be kept from growing together. Narrow rows of 18 inches are sufficiently wide.

Cover Crop Helps to Ripen Canes for Winter

It may help the raspberry plants to mature and harden off for winter, in case of a rainy, late summer and early fall, to have a crop of oats or weeds growing in competition with them throughout the months of September and October. If this cover crop tends to grow rather tall, it may be advisable to tramp or break it down so that sunlight will not be shut off from the canes too much.

Currants & Gooseberries

At this time one has an opportunity to observe where the largest berries and the best filled bunches are located. Canes which have short, poorly filled bunches of small berries, have outlived their usefulness and should be removed. The best time to remove them is while the crop is on. It is a sure way to remove the poorest wood in the bush. Also, look for wilted tops of young shoots; cut them off and burn them to destroy the borer inside.

Grapes

Train Young Vines

Most of the newly planted grape vines make excellent growth in the spring. These plants should be trained to develop not more than two strong canes. If they have grown much, it may be advisable to tie the canes to a post.

Winter Protection

Lay the vines down in late October or early November and cover them with about 3½ inches of soil.

Reference: Horticultural Dept., University of Wisconsin

SPRAYING FARM ORCHARDS

It continually becomes more important to make every part of the farm contribute to the farm income or to reduce the expenditures of farm and family. The farm orchard may help in both these ways, when properly cared for, but if neglected, it becomes a liability. Spraying for the control of orchard insect and disease pests is necessary in proper orchard care. Without it, one cannot expect much in the amount of fruit produced and less in the quality of the fruit. Every farmer will find that it pays to spray his orchard thoroughly at the right time and with the right material.

Many farmers are finding that the best methods of taking care of spraying their orchards is through a co-operative organization called a "spray ring".

"Spray Ring" Cuts Costs

One of the advantages of the spray ring which most strongly appeals to the owner of a small orchard is that he can have more efficient spraying through the spray ring at less cost than if he has his own equipment and does his own spraying. This is possible through the ability of a group to purchase more efficient equipment than would be practical or possible for the individual farmer to possess. The spray operator becomes more experienced in the work than the individual farmer would because he has a much larger number of trees to spray. The county agent or fruit specialist of the Agricultural College can give more service as he can concentrate on one man in a way which would not be possible if there were eight or ten doing the spraying in each ring. All this results in more efficient work at a reduced cost, and, therefore, a greater profit from spraying.

A spray ring consists of six to twelve farmers who live close together. The exact number is largely dependent upon the number of trees each has, and the distance between the orchards of the members. The members co-operatively purchase a spray machine costing from $250 to $350. The most satisfactory method is for the growers to own equal shares regardless of the number of trees which they may have. The cost to each farmer is much less than he would have to pay for an outfit which would do his work even in an inefficient manner. It is desirable to have a president, vice president, and secretary-treasurer, who have charge of all business of the ring. A simple constitution and by-laws are an aid in the business management of the ring. Sample copies can be obtained from the Horticultural Department, University of Wisconsin.

Operator Service

A member is employed as operator. He attends to the spraying of the orchards of the members at the proper time and in the right way. He distributes the costs of spraying on the basis of the amount of time and materials used in spraying each orchard. His pay is fixed by agreement at the beginning of the season. The operator is the principal factor determining the success of the enterprise and should be carefully selected. He should be sufficiently interested in his job to put forth every effort to become familiar as quickly as possible with the fundamentals

underlying successful spraying and the details necessary to efficient work.

Spraying Practice

As it is not necessary to make a separate application of spray material for each pest which it is desired to control, schedules are made of times of spraying and the amounts and kinds of materials which it is desirable to use for control of those pests usually necessitating control measures. If the home orchardist wants to produce a commercial grade of fruit, he should use a commercial spraying program. If an application is omitted, there is danger of unsatisfactory control.

Dormant Sprays for Apples

When scale insects, case bearers and leaf rollers are present in considerable numbers, a dormant spray is necessary. Dormant sprays should be applied before growth starts. Use a standard prepared dormant spray oil at 4% strength. For leaf rollers use it at 5% strength.

Reference: Wis. Stencil Cir. 157 - "Spraying Farm Orchards" - Rev. Feb., 1943

WISCONSIN FARM ORCHARD SPRAY PROGRAM

SPRAYS	MIXTURE USED	PESTS TO CONTROL
1. Green Tip (See Note 1)	2 gal. liquid lime sulphur 2 lbs. lead arsenate 100 gallons of water	Apple and pear scab
2. Prepink (See Note 2)	Same as 1.	Same as 1.
3. Pink (See Note 3)	Same as 1.	Scab, curculio, canker-worm; cherry leaf-spot; and brown rot of plum.
4. Calyx (See Note 4)	2 gal. liquid lime sulphur 2½-3 lbs. of lead arsenate 100 gallons of water	Same as above and for the first brood of cod-ling moth.
5. 10 days after Calyx	Same as 4.	Same as 3 and 4.
6. 30 days after Calyx spray (See Note 5)	1½ gal. liquid lime sulphur 2 lbs. of lead arsenate 100 gallons of water	Codling moth, apple scab; and brown rot of plum.
7. Apple Maggot - Spray date de-termined by bait traps.	Same as 6.	Apple maggot
8. August 10-20 (See Note 6)	Same as 6.	2nd brood of codling moth, apple maggot, apple scab; cherry leaf-spot; and brown rot on late plums.

Note 1. Apply as soon as early variety buds show ¼ to ½ inch of green tips.
" 2. Apply as soon as late variety buds show ½ inch of green tips.
" 3. Apply as soon as early blooming varieties show pink.
" 4. Apply as soon as late blooming varieties have dropped 3/4 of their petals.
" 5. This spray may be earlier or later than 30 days after Calyx. Use bait traps as guide.
" 6. This spray may vary in different seasons. Use bait traps to determine exact spraying date.

Dry Lime Sulphur: 4 lbs. are the equivalent of 1 gal. of liquid lime sulphur.
Plant Lice or Aphids: Use nicotine sulphate, one-half pint to 50 gal. of spray in the green tip application if necessary.
Dormant Orchard Spray: For scale insects, use 1 gal. of liquid lime sulphur in 7 gal. of water; or, use one of the miscible oils according to manufacturers directions.
Raspberry Anthracnose: Apply lime sulphur, 1 gal. in 9 gal. of water when first leaves unfold.

No. 1. Green tip or delayed dormant spray.

For time of application see Fig. 1, A-B, on Page 11. Use lime sulphur, one gallon and arsenate of lead, one pound in water to make 50 gallons of spray. If plant lice are numerous, add ½ pint of 40% nicotine sulfate to 50 gallons of this spray.

No. 2. Closed cluster or pre-pink spray

The period between the delayed dormant and open cluster sprays is very critical for scab control. Ordinarily one closed cluster application should be made at about the stages shown in Fig. 1, C-D. In occasional very cold, slow seasons, this treatment should be made about stage C, and an additional application made between D and E of Fig. 1. In occasional unusually warm seasons, development may be so rapid that no closed cluster spray is needed. In general, however, it is risky to omit this application. Use the same materials as in No. 1.

No. 3. Open cluster or pink spray

Just before the blossoms of early flowering varieties are open and preferably after the blossom buds have separated in the cluster. Use the same materials as in No. 1. If for any reason this spray is delayed until many blossoms are open, leave out the arsenate of lead to avoid the possibility of poisoning pollinating insects.

No. 4. Calyx spray

As soon as most of the petals on the later flowering varieties have fallen and before the calyx is closed. Use lime sulphur one gallon and arsenate of lead one and one-fourth pounds to 50 gallons of spray. This is an especially important spray for codling moth, curculio, and scab.

No. 5. Ten-day spray

Ten days after No. 4. Use lime sulphur one gallon and arsenate of lead one and one-fourth pounds to 50 gallons of spray. Lime sulphur is likely to cause some injury to fruit and foliage if the weather is very hot at the time of application or soon after it. In hot weather, if scab has been well controlled, a wettable sulphur spray may be substituted for lime sulphur at the strength recommended by the manufacturer. The wettable sulphur sprays will not give as long a period of protection against scab per application as lime sulphur. If they are used, it may be necessary to give an additional treatment between 5 and 6.

No. 6. Thirty-day spray

Thirty days after the calyx spray. This spray may need to be advanced or delayed somewhat depending upon weather conditions. Use lime sulphur one gallon and arsenate of lead one pound to 50 gallons. This spray is important in the control of codling moth and also for scab, especially when scab has not been well controlled

by the earlier sprays. When the temperature is 85 or over and scab has been thoroughly controlled, a wettable sulphur spray may be substituted at the strength recommended by the manufacturer. If scab is bad, put on the lime sulphur.

No. 7. Apple Maggot spray

This pest has become increasingly important and a spray of lead arsenate, one pound to 50 gallons of water is necessary to control it. Proper timing of this spray is very essential. It is usually applied about July 25 in the western part of the state, and in the eastern and northern sections somewhat later. Bait traps or emergency cages are used to time this spray. For a special circular on how to prepare the bait or make the cages write to the Department of Economic Entomology at Madison. Lime sulphur, 3 quarts to 50 gallons, or a wettable sulphur at the strength recommended by the manufacturer should be added if needed for scab control. Under heavy infestations a second spray is necessary in about ten days. Usually spray No. 8 serves this purpose. It will pay to pick up and destroy all windfalls starting the first week of August, doing this every week until harvest.

No. 8. August or second brood codling moth spray

The proper time for putting on this spray varies with seasonal conditions and particularly with the section in which the orchard is located. In southern Wisconsin the time is about August 10 to 15. Along the Lake Michigan shore and in sections farther north the date of application will be somewhat later. Use lime sulphur one gallon and lead arsenate one pound to 50 gallons. This spray may be omitted on varieties to be harvested within three weeks.

Amount of Spray Material Needed

The amount of material needed to thoroughly spray a tree varies with the size of the tree and the time at which the application is made. The average amount of material needed for trees of various ages, when in leaf is about:

Age of tree in years	10	12	15	20	25
Gallons of spray	2	2½	3-4	4-5	5-6

Fig. 1 -- Stages for applying Pre-Blossom Sprays

A - B -- Spray No. 1 - Green Tip or Delayed Dormant

C - D -- Spray No. 2 - Closed Cluster or Pre-pink

E -- Spray No. 3 - Open Cluster or Pink

Fig. 2 - Ready for "Calyx" Spray

SPRAYING OTHER FRUITS

In home orchards the number of other fruit trees and other fruit plants is so small that they are sprayed at the same time the apple trees are sprayed. In following this plan the following exceptions to the apple spraying program are suggested:

Cherries and Plums

Satisfactory results will usually be obtained in home orchards if sprays 4, 5 and 8 are used. On plums a wettable sulphur, at the strength recommended by the manufacturer and 3 pounds of hydrated lime per 50 gallons will give better results than lime sulphur. Do not apply sprays on fruits nearly ready to harvest.

Grapes

When black rot or mildew has been prevalent, use 6-6-50 Bordeaux when new growth is 1/2 to 3/4 inches long. Repeat with 4-4-50 Bordeaux just before blossoms open and again when the fruits are about the size of a pea. If there is evidence of the presence of leaf eating insects or berry moth add 3 pounds of arsenate of lead.

Currants and Gooseberries

Currant Worms

Arsenate of lead, one pound; water, 50 gallons. Whenever worms are present, examine plantation at least once a week from May 15 to September 1, for presence of the pest. Usually not troublesome after fruit has been harvested.

Currant lice (aphis)

Use $\frac{1}{2}$ pint 40% nicotine sulphate to 50 gallons of water. Add two pounds of soap in solution. Spray just as buds begin to open.

Raspberries and Blackberries

Anthracnose

When this disease is very bad, use lime sulphur, 1 gallon; water, 10 gallons, when first two or three leaves have unfolded. Also lime sulphur, 1 gallon; water 40 gallons, one week before plants bloom.

Crown gall

Use healthy stock and plant in soil where crown gall has not been found.

Orange rust

Remove promptly and burn infested plants.

Cane Borers

Prune out and burn all infected canes in early spring or late fall. When

the raspberry cane borer causes the tips to wilt in June or July, cut off the wilted tips a few inches below the wilted area.

Raspberry Fruit Worm

The adult insect feeds in the blossom buds. Spray with calcium arsenate 2 pounds to 50 gallons of water as soon as any injury is noted. If there is heavy infestation repeat at 3-day intervals until the blossoms open. Calcium arsenate dust may be used instead of the spray.

Strawberries

Leaf Spots

Cut off and burn the leaves immediately after harvest.

Leaf roller

Spray with arsenate of lead three pounds to 50 gallons of water as soon as rolling is noted. Cutting off and burning the leaves immediately after harvest also helps in control.

Root Aphis

Use plants known to be free from this insect.

Small Quantity Formulas

When preparing sprays in small quantities it is very convenient to have a postal scale and a measuring spoon such as is used in the kitchen. It is more satisfactory to weigh dry materials. The following formulas give spray material of about the same strength as those used in commercial orchards:

Lime Sulphur

1 to 7--liquid, one pint to one gallon of water. Dry, four ounces (8 level tablespoonfuls) to one gallon of water. 1 to 40--liquid, one pint to five gallons of water. Dry, 1 ounce (2 tablespoonfuls) to 1 gallon of water.

Nicotine Sulphate

One teaspoonful to one gallon of water; 3/4 ounce of soap in solution.

Arsenate of Lead

1 to 50--two level tablespoonfuls to one gallon of water or one ounce to 3 gallons.

Bordeaux Mixture

For method of preparing Bordeaux Mixture see Wisconsin Circular 113. 6-6-50--Six ounces copper sulphate; 6 ounces stone lime or 8 ounces fresh hydrated lime; water, 3 gallons. 4-4-50--Four ounces copper sulphate; 4 ounces stone lime or 6 ounces fresh hydrated lime; water, 3 gallons.

Reference: Wis. Stencil Circular 157 -- "Spraying Farm Orchards" -- Rev. Feb., 1943.

REPAIR YOUR SPRAYER EARLY IN SPRING

The labor situation, as every farmer knows, is serious. Full-time use must be made of all available help. Breakdowns of machines are wasteful and costly. Special care must be taken with parts made of critical materials like brass, stainless steel, aluminum, and rubber. With transportation limitations, it may be difficult to obtain replacement or repair parts from your dealer on short notice. Unnecessary breakdowns will be wasteful of our limited labor supply. Your sprayer is a vital piece of equipment in carrying out the Food-for-Freedom program. Careful overhauling of your sprayer before the spraying season will help to keep it on the job of winning the war. Avoid the need of repairs by paying special attention to cleaning, lubrication, and adjustments.

General	___	1. Entire machine thoroughly cleaned.
	___	2. Exposed parts subject to rusting covered with heavy oil or grease.
		3. Repainting done as needed.
Pump	___	1. Plunger packings inspected (replace if necessary)
	___	2. Valves thoroughly cleaned & checked (replace only if necessary).
	___	3. Valve gaskets inspected (replace if worn).
	___	4. Gears & gear alignment checked (loose bearings cause rapid wear).
	___	5. Wrist pins & all bearings checked for looseness & wear.
	___	6. New oil seals & packing around plunger rods (on enclosed pumps).
	___	7. New oil put in & pump run for few minutes (in enc. pumps) to coat.
Pressure Regulators	___	1. Condition of rubber diaphragm or leather cup checked.
	___	2. Valve ball & seat directly above the stem inspected (important).
	___	3. Packing around top of stem tightened, or replaced.
	___	4. Stem carefully adjusted according to directions in instruction book.
Drive Parts	___	1. Drive gears adjusted to mesh properly (important for maximum power).
	___	2. Chain drive removed, washed in kerosene, recoiled, replaced, adjusted.
	___	3. Power take-off universals checked. (Extreme wear indicates poor hookup or carelessness in turning.)
		4. Sliding square shaft greased.
Suction to Pump	___	1. Strainer screen thoroughly cleaned (for maximum efficiency).
	___	2. Suction hose inspected for cracks or holes (must not leak air).
	___	3. Pipe connections checked and tightened.
Tank	___	1. Rust pits cleaned & coated with heavy oil or light grease.
	___	2. Hoops on wood tanks tightened (loosen if staves swell in next use).
	___	3. Agitator overhauled; bearing greased with water-pump grease.
Discharge Equipment	___	1. Spray hose drained well & stored in large coil away from heat, light.
	___	2. Spray discs checked for wear; guns repaired and oiled.
	___	3. Nozzles removed, cleaned, and stored in oil.
Truck & Frame	___	1. All bolts checked and loose ones tightened.
	___	2. Breaks and cracks repaired by welding.
	___	3. Wheel bearings greased.
	___	4. Hitch checked for needed repairs.
Engine	___	1. Compression checked (Do valves need grinding, pistons need new rings?)
	___	2. Bearings checked for looseness or wear.
	___	3. Spark plugs removed, cleaned, & adjusted (replaced if necessary).
	___	4. Air passages of radiator well cleaned (blocking causes overheating).
	___	5. Magneto spark checked (if weak, take magneto to good repair man).

Reference: Conrad L. Kuehner, Fruit Specialist, University of Wisconsin.

APPLE THINNING IN THE FARM ORCHARD

Apple thinning is a widely adopted practice in commercial orchards of the United States, and is also practiced in a number of Wisconsin orchards.

A. The main objects of thinning are:

1. Increase in size of fruit
2. Increase in color of fruit
3. Greater uniformity of fruit
4. Larger percentage of fancy and No. 1 fruit
5. More ready more profitable sales

B. When to thin:

As a general practice, thinning is done as soon as most of the "June Drop" is over. The time varies with seasons and localities as well as varieties. It is well to get the job completed before the fruit has developed very much. The work may be started in June and should be completed by the end of July.

C. Some varieties which it pays to thin:

Wealthy, Golden Delicious, Stayman Winesap, Northern Spy, Wolf River, Grimes Golden, Jonathan, also Snow and McIntosh on some trees in some years.

D. How to thin:

1. Shake branches to remove "June drop" still adhering to spurs
2. Remove all wormy, scabby, and small sized apples
3. Leave the largest apples
4. Thin clusters to one fruit
5. Space single fruits to from 6 to 8 inches
6. Remove apples with fingers and thumbs or thinning shears. (Do not injure spurs or leaves.)

E. What trees to thin:

1. Healthy trees of quality eating varieties
2. Biennial bearing trees with heavy set
3. Bridge grafted and also partly girdled trees.

APPLE STORAGE ON THE FARM

Harvesting

A. When to Pick:

Most varieties of apples are ready to be picked when the following conditions obtain:

1. Change of color of the unblushed portion of the apple from dark green to light green; from light green to yellowish, from yellowish to whitish color depending upon the variety.

2. When apples still offer some resistance to removal from the spur.

3. Apples should be mature but still hard -- if ripe enough to eat at picking time, their storage life will be considerably reduced.

4. Summer and fall apples should be color picked, making three or more separate pickings each time removing the largest and best colored specimens.

B. How to Pick:

1. Pick by hand into a bucket or a picking bag to reduce handling bruises and stem punctures.

2. Use wide spreading, tripod type stepladders for safe picking and accessibility to all parts of tree.

3. Keep picked fruit in the shade from the time it is picked to the time it goes into storage.

C. Storage Containers:

1. The bushel basket, the common Western apple box, storage crates, the new Eastern Gift Apple Box are all satisfactory storage containers. Do not store apples in bins or piles.

2. Use clean containers. Unclean containers cause apples to be musty and unfit for use.

How and Where to Store Fruit

A suitable place usually can be provided in the farm home cellar by partitioning or boarding off a space 8 x 8 feet, or larger. The coolest corner of the cellar, with a north or west window to the outside, is best. This may be quite satisfactory if certain precautions are carefully observed. They are:

A. Kind of Fruit to Store:

Store only fruit which is properly matured, free from disease and insect damage, stem punctures, bruises, and other injuries.

B. Wrapping the Apple:

Varieties of apples such as Snow, McIntosh, Wealthy, Tolman Sweet,

Golden Russet, Seek-No-Further, and a few other kinds will retain their choice qualities much better and longer when they are wrapped in a clean piece of paper. The special oiled apple wrapper is best because it helps to prevent storage scald. For ordinary medium sized apples the 9 inch wrapper is large enough. The apples should be wrapped at the time when they are placed into permanent storage.

C. Stacking the Containers of Fruit:

In stacking the baskets or boxes of fruit, place easily-wilted varieties on the floor, and the less easily-wilted kinds on top of them. A 4 to 6" space between the walls and the stacks of fruit allows more efficient air circulation. Boxes are preferred for storage because of space economy and easier stacking.

D. When and Where to Store:

As soon as the fruit has been picked, sorted, and placed in containers it should be removed to a place where it can be kept as consistently cool as possible. An open shed or porch on the north side of a building, with proper protection from sun and rain, is a better early fall storage place than the ordinary farm cellar. This is because the fruit chills better at night where it is exposed to the cool night air than is possible in the enclosed storage where provisions for air circulation are inadequate and soil temperatures keep the storage warm.

Apples may remain in this open storage until the outside temperature drops a few degrees below freezing point, when they should be removed to the cellar or storage house for the winter.

E. Storage Temperature:

The storage room should be kept at an even, low temperature, as near 32° F. as possible. While it is not so easy to hold the temperature of the cellar as near 32° F. as may be desired, it is still much better to hold it at 40° to 45° F. than at 50° to 60° F. or higher. Doors and windows should be open on cool days and during the night and kept closed when the outdoor temperature is higher than the temperature inside of the storage room. This also applies when the outside temperature drops much below 32° F. Most folks are inclined to close the windows as soon as it turns cold outside. This is a mistake for the storage room gets considerable heat from the soil against the walls of the building. Outside temperatures may drop considerably below 32° F. before the windows need to be closed.

F. Storage Moisture or Humidity:

While a ground floor is best for fruit storage, it is not always practical. Cement floors may be provided with a 4 to 6 inch deep cover of sand or ground which can then be kept soaked with water, to furnish moisture to the storage air. In this way fruit shriveling can be reduced to the minimum. A false slatted floor should be built over the sand leaving an air space of 6 to 10 inches between the sand and the slats of the floor. This will provide good air and moisture circulation underneath the floor and through the stacks of baskets or crates of fruit.

G. Walls and Ceiling:

The partition walls and ceiling may or may not be packed with an insulating material such as shavings or a suitable commercial insulation fill in the space afforded by the 2"x4" upright studdings of the walls and the joists of the ceiling. In either case, whether the walls and ceiling are filled with insulation material or are left hollow, it is advisable to use vapor-proof paper under the sheathing of the joists of the ceiling and on the inside of the studdings of the walls and door. This paper should lap on the studdings and the joists so that a tight seal results when the boards are nailed into place. Shiny black vapor-proof paper is both inexpensive and readily obtained at lumber yards. Both sides of the partition walls and the ceiling should be boarded tightly with tongue and grooved or matched lumber. Insulation board may be substituted for lumber on the outside of the partition walls. Insulation fill should not be omitted if the storage room is in a heated basement.

H. Wall Footing, Window and Door:

The base of the walls should rest upon a footing of one course of light weight 6 or 8" cement block or poured concrete painted with hot asphalt to make it waterproof. The window should be fully screened to keep out rodents. One window pane should be removed (if pane is small, remove two) to receive the cold air duct. The remaining part of the window is then fitted and hinged, either on top or at one end so that it may be partly or entirely opened, thus providing a control for the warm air outlet. If the storage room has two windows, use one for the cold air inlet, the other for a warm air outlet. The door should be constructed the same as the walls, and the door stop provided with weather stripping to make the door close tightly when shut.

I. Cold Air Duct:

To provide efficient air circulation, it is advisable to build an 8"x8" or larger ventilating duct. Its size will be determined by the size of the window or pane which it replaces. If the panes are small, the duct should be built large enough to replace two panes. The cold air inlet must be large. The duct should be built of good lumber that is tightly fitted. (A strip of building paper laid between board joints will make very tight joints after the boards are nailed together.) The duct should start about 12 to 18" above the basement floor, rise along the wall up to the window, then make a rightangle turn and pass through the open window to the outside. The outside opening should be covered with 1/4 to 1/2" mesh hardware cloth. A sliding damper should be provided in the duct at a convenient height below the window to allow for the regulation of cold air inflow.

J. Management of the Storage:

The best storage will not give efficient service unless it is given constant attention. Full advantage must be taken of temperature variations to keep the room as cool as possible and to maintain proper humidity at all times. In the fall months, the cold air duct and the warm air outlet should be wide open at night and on cool days, but closed on warm days. As the weather gets colder, the cold air damper and the warm air window need to be regulated accordingly. Sprinkling

must be often enough to keep sand or ground wet.

Not all farm homes may find it practical to provide a separate fruit storage room. It will need to be a combined fruit and vegetable storage. In such storages some varieties of apples and pears will take on a vegetable flavor. To minimize this objectionable feature, it is advisable to keep fruits and vegetables separate and to maintain efficient ventilation.

Apples as Gifts

Apples make acceptable gifts at any time of the year for almost everyone likes and enjoys a crisp, juicy apple. Think about presenting some of your friends with an attractively packed basket or carton of your choice eating apples. They will be appreciated and you will give your apples a lot of good advertising at small cost.

WISCONSIN APPLES LISTED ACCORDING TO USE

The following lists include some varieties not recommended for planting. They appear in this table because they can very well be utilized in different ways until better varieties can replace them.

USE	Varieties		
	Summer	Fall	Winter
Eating	Melba (new) Yellow Transparent Early McIntosh (new) Milton (new) Whitney Sweet Russet Crab	Milton Wealthy Snow McIntosh Cortland	Cortland McIntosh Red Delicious Golden Delicious Northern Spy Jonathan Grimes Golden Tolman Sweet Macoun (new) Secor (new) Malinda
Cooking	Yellow Transparent Duchess Dudley Early Red Bird (new) Milton	Milton Wealthy McIntosh Cortland Wolf River Pewaukee Twenty Ounce Hibernal Joan (new) McMahon	N. W. Greening Patten Greening Winter Banana Northern Spy Haralson (new) Prairie Spy (new) Willow Twig Perkins (new) Stayman Winesap Jonathan Salome Grimes Golden Golden Delicious
Baking	Dudley Milton	Dudley Milton McMahon Wealthy McIntosh Cortland Twenty Ounce Joan Wolf River	N. W. Greening Patten Greening Winter Banana Minn. 790 (new) Willow Twig McIntosh Cortland
Canning	Whitney Sweet Russet Crab Transcendent Crab Florence Crab Virginia Crab	Longfield Hyslop Crab	Hyslop Golden Delicious Malinda Tolman Sweet Salome
Jelly	Dolgo Crab Transcendent Florence Virginia	Hyslop Crab Wealthy	Salome Winesap

SECTION VI - DAIRY CATTLE

(Continued)

FEED BALANCED RATIONS

The quality of much of the hay that is usually harvested each year is not the best. This is due to frequent rains which make it difficult to cure properly. As a result, there is much stemmy and discolored alfalfa hay, soybean hay, and other kinds of hay. Unless hay is bright green in color and leafy, it has lost a large part of its feed value, especially proteins, minerals and vitamins that are so necessary for young stock, for breeding stock and for milking cows.

Where a dairyman is obliged to use alfalfa hay, soybean hay or clover hay which is musty, stemmy and with leaves largely shattered, or where the hay was brought into the barn too damp, with heating and steaming as a result, the grain mixture will have to make up for part of the losses. Thus the mixture should contain an increased amount of protein -- depending upon the extent of the damage or the losses.

Feed of high quality, grown upon the farm, is the backbone of economical and efficient milk production; and good legumes for use as hay, silage and pasture are the answer to quality roughage and economical rations on most Wisconsin farms.

With roughages on hand as a base, the dairyman can choose a grain ration which will supply his herd with the feed needed for economical and efficient milk production. The table on the following page will help in determining the amount of protein needed in grain rations with different quality roughages.

GOOD CORN SILAGE

Corn silage is one of the most palatable and nutritious silages when properly prepared. At its best, corn silage is rich in carotene as well as other nutrients, and when it must be fed with poor quality hay such good silage may make the difference between good and poor health, growth and reproduction of farm animals. The milk of cows fed such good roughage is also richer in vitamins.

To make the best silage, corn should be ensiled when neither too ripe nor too green. Corn is too ripe for silage when many or most of the leaves have turned yellow, and when the kernels on the ears have been fully dented for some days.

Corn is too green for silage when the kernels are still in the milk stage. There is a low yield of digestible nutrients and a silo may "weep" at the base, losing many soluble nutrients. Also the silage is soggy and may not be palatable.

Corn is ready for ensiling when the kernels of the ears have barely finished denting and when all or nearly all leaves are still green. Since silo filling usually takes several days, it is desirable to start filling a few days ahead of time, or when the kernels are just beginning to dent.

Reference: Wis. Circular 337 - "Good Corn Silage" - June, 1943

A. Choose Grain Mixtures According to Roughage

When the Roughage* Is:	Total Protein Needed in the Grain Ration:
--good legume hay with well preserved legume silage, -or- --the above with limited amount of corn silage, -or- --good quality alfalfa hay without silage, -or- --fine quality alfalfa hay fed liberally with only limited amounts of corn silage.	10 to 12 per cent
--good quality alfalfa or soybean hay with corn silage -or- --mixed hay with good legume silage fed liberally.	12 to 14 per cent
--good leafy clover hay with corn silage, -or- --medium quality alfalfa hay with corn silage -or- --good clover-timothy hay without corn silage	14 to 16 per cent
--good clover-timothy hay with corn silage, -or- --good clover-timothy hay with corn fodder, -or- --alfalfa hay that has been weathered and has lost considerable of its leaves, with corn silage.	16 to 18 per cent
--timothy or millet, or canary grass hay, with or without corn silage, -or- --timothy or millet or canary grass hay with corn fodder or shredded corn stover,**	18 to 20 per cent

Having picked from the above roughage combinations the one that most nearly fits the particular farm condition, the right hand column gives the answer as to what protein content there should be in the grain mixture. Various mixtures may be used, depending on the feeds available, or cheapest if they need to be bought. Sometimes simple mixtures are quite efficient and more profitable than other mixtures that include a great variety of feeds, sometimes expensive feeds.

*The roughage rations highest in protein are at the top, and those lowest, at the bottom. The protein content of the grain mixtures therefore compensate for lack of roughage protein.

**Good bright corn stover is about equal to average timothy hay in feeding value. It should not form any large part of the roughage ration for high-producing cows. Early cut timothy hay is much superior to late cut timothy hay for dairy cows.

Reference: Wis. Special Circular - "What to Feed" - Dec., 1942

B. Have Right Amount of Protein in Concentrate Ration

When the feeds that are to make up the concentrate ration have been selected, write down the names of each feed, one below the other, with the home grown feeds at the top of the list.

Set down opposite each feed the percentage of protein in the feed (See table below). The protein percentages of different feeds will be found in the table on the next page.

By a little figuring, find the amounts of the various feeds required to secure the proper protein percentage in the ration. For easy figuring use rations of 100 to 1000 pounds. Here is an example:

Feeds Available	Total Protein %	Ration 1		Ration 2		Ration 3	
		Pounds feed	Pounds protein	Pounds feed	Pounds protein	Pounds feed	Pounds protein
		%		%		%	
Corn-and-cob meal	8	500 x 8 =	40	400 x 8 =	32	200 x 8 =	16
Barley	12	200 x 12 =	24	200 x 12 =	24	200 x 12 =	24
Oats	12	200 x 12 =	24	150 x 12 =	18	200 x 12 =	24
Gluten feed	24			150 x 24 =	36	200 x 24 =	48
Linseed meal	34	100 x 34 =	34	100 x 34 =	34	200 x 34 =	68
Pounds protein in 1000# feed.....			122		144		180
Per cent protein in ration.....			12.2		14.4		18.0

By varying the amounts of the different feeds, we have here worked out rations of three different protein percentages. Other feeds than those given may be used and the desired protein content of a ration secured by selecting the correct amount of the various ingredients.

C. Feed All the Good Roughage Cows Will Clean Up

A thumb rule which may serve as a guide is to "feed one pound of hay and three pounds of silage per day for each one hundred pounds live weight of the cow." If fed according to this rule, a 1200 pound cow would receive 12 pounds of hay and 36 pounds of silage per day.

If plenty of good quality hay, such as leafy alfalfa, is at hand, it may be fed in larger amounts. Some cows will eat two pounds or more of hay of good quality and two pounds of silage per day for each one hundred pounds of weight. If good legume hay is fed liberally and corn silage fed in limited amounts, less protein will be needed in the grain ration.

D. A Handy Table of Common Feeds for Dairy Cows

Feed	Total protein	Total dig. nutrients	
	%	%	
Corn, ground	9	80	A staple feed, palatable and high in energy value.
Corn & cob meal	9	76	Because of its bulk, especially useful in rations where other feeds are heavy.
Hominy feed	11	85	A corn product about equal to ground corn. May replace corn or barley in the ration.
Barley, ground	12	79	A good feed. Not quite as palatable as corn and oats. Use it up to 40 to 60% of ration. Grind coarse.
Oats, ground	12	72	A very good cow feed, palatable & bulky. Especially good for growing stock.
Rye, ground	12	80	While not as palatable as corn, barley or oats, can satisfactorily make up 40% of ration in replacing these feeds.
Wheat, ground	13	84	A satisfactory feed nearly equal to corn when fed in properly balanced rations. Use it up to 40% of ration if desired. Grind coarse.
Molasses, Cane	3	57	Especially good for dry cows and for improving the palatability of other feeds. Usually less valuable than corn on strict feed value basis.
Wheat bran	16	70	A very good medium rich protein feed high in phosphorus. Bulky & mildly laxative.
Wheat middlings Stand.	17	78	Lacks the bulk of bran but may replace it in the ration when the price warrants.
Dried brewers grains	25	65	A bulky, medium high protein feed, not too palatable, but may make up a third of the grain mixture when used with well liked feeds.
Gluten feed	24	74	A very satisfactory protein-rich feed. May be used as chief protein concentrate when cows get plenty of good legume hay.
Linseed meal	34	78	An excellent palatable, high-protein feed, quite high in phosphorus.
Soybean oil meal	44	82	A valuable high-protein feed containing proteins of excellent quality. Equal to linseed meal for cows.
Gluten meal	41	82	Richer in protein than gluten feed and much heavier, otherwise the statement for gluten feed applies.
Cottonseed meal	43	76	A good protein-rich feed, high in phosphorus. May replace linseed & soybean or gluten meal when price warrants.
Soybeans, ground	36	94	Equal to linseed meal as a protein supplement. Very high in fat. May use up to 1/4 or 1/3 of grain ration.

E. Grain Mixtures That May Be Fed With Different Roughages

	Protein Content of Mixtures				
	10-12	12-14	14-16	16-18	18-20
	(1)	(2)	(3)	(4)	(5)
Ground wheat, barley, or rye....	600	600	600	600	400
Ground oats.....	700	600	600	400	400
Ground corn, or corn-and-cob meal.....	700	600	400	400	400
Gluten feed, or dried brewers' grains.....	---	100	200	300	400
Soybean oil meal, or linseed meal.....	---	100	200	300	400
Salt.....	20	20	20	20	20
Bone meal.....	30	20	20	--	--
Total.....	2050	2040	2040	2020	2020

	Protein Content of Mixtures				
	10-12	12-14	14-16	16-18	18-20
	(6)	(7)	(8)	(9)	(10)
Ground wheat, barley, or rye....	800	800	700	600	500
Ground oats, corn, or corn-and-cob meal.....	1200	900	800	700	600
Wheat bran, middlings, or 16% dairy feed.....	---	100	200	200	300
Gluten feed, dried brewers' grains, malt sprouts, or 24% dairy feed.....	---	100	100	300	300
Soybean oil meal, linseed meal, gluten meal, or cottonseed meal.....	---	100	200	200	300
Salt.....	20	20	20	20	20
Bone meal.....	30	20	20	---	---
Total.....	2050	2040	2040	2020	2020

Where grains or concentrates need to be purchased, wheat, corn, gluten feed and the oil meals at present are some of the more economical feeds; wheat bran, middlings, molasses, and oats some of the more expensive.

Bone meal or other phosphorus mineral usually is necessary only with the low-protein grain mixtures that are fed with legume roughage -- in case this should have been grown on phosphorus-deficient soil. If grown on fertile soil, there is little need for added minerals other than salt.

F. Feed Grain According to Production

If the herd is not being tested for production, it will pay to weigh the milk from each cow once a month, or oftener, in order to have a basis on which to feed grain.

Here are a few of the thumb rules for feeding grain to cows:

1. Feed one pound of grain per day for each three pounds of milk from Jersey and Guernsey cows; one pound of grain to four pounds of milk from Holstein cows; and one pound of grain to three and one-half pounds of milk from Ayrshire, Brown Swiss and Shorthorn cows.

2. Where cows are tested in D.H.I.A. and the monthly fat production of each cow is known, grain may be fed as follows, according to the fat produced:

   a. With poor quality roughage:
      --Monthly fat produced, divided by 4 equals amount of grain to feed per day.

   b. With medium quality roughage:
      --Monthly fat produced, divided by 5 equals amount of grain to feed per day.

   c. With excellent roughage, fed liberally:
      --Monthly fat produced, divided by 6 equals amount of grain to feed per day.

Figured on this basis, a cow producing 40 pounds of fat per month would get ten pounds of grain per day if roughage were of poor quality, eight pounds if the roughage were of medium quality, and about seven pounds if the roughage were of excellent quality and fed liberally.

G. Other Feeding Suggestions

1. Grinding

Barley, wheat and rye, when ground too fine, become pasty in the mouth of the cow. These feeds are more palatable and more readily eaten when ground medium coarse.

Where grains are heavy and lack bulk, it will be well to feed them on top of the silage.

When corn-and-cob meal makes up a considerable part of the ration, feed a little extra grain. Corn-and-cob meal is bulky and may be better than ground shelled corn where the other feeds in the ration lack bulk.

2. Salting

Salt cows according to their needs, and do not force them to eat more salt than they may require. A good method is to mix one per

cent of salt in the grain ration, and in addition give the cows access in the barnyard to block salt or loose salt. If the hay has been salted, allow cows free access to salt in the barnyard, but do not mix any in the ration. Salt cups are a satisfactory method of salting.

3. Commercial Feeds

Good commercially mixed feeds may be mixed with home grown grains to make satisfactory rations. Buy these feeds on analysis and price and the reputation of the company that mixes them. While the feeds mixed by reliable companies are of excellent quality, some ready mixed feeds contain a great deal of filler, sweepings, and weed seeds.

4. Minerals

While most rations will contain enough of the necessary minerals, aside from common salt and iodine, there may be occasional need for extra phosphorus. Where rations that are largely home-grown are fed to high producing cows, it would be well to give cows free access to a good quality of feeding steamed bone meal, into which 10 per cent of salt has been mixed.

In acid soil areas, give cows access to a mineral mixture containing equal parts of bone meal and calcium flour.

If there is any question of an iodine deficiency, feed iodized salt. If, on the farm, there have been any cases of goiter in calves or hairlessness in pigs, it is evidence of an iodine deficiency, and iodine should be supplied.

H. Feeding Cows on Pasture

With the cows on pasture, the same rule needs to be followed as with cows in the barn -- the better the pasture the less protein needs to be in the grain ration, and the other way around. So by checking the kind of pasture that is being used, the necessary protein content of the grain mixture is given in the right-hand column of the following page, and a suitable mixture may be chosen from the same list from which we chose a grain ration for barn feeding.

Reference: Wis. Special Circular -- "Balance the Ration" -- (Rev.) Oct.,1941

H. Feeding Cows on Pasture (Cont'd.)

	When the Pasture is:	Total Protein Needed in the Grain Ration:
1	Lush early spring grass or very early rye	9 to 10 per cent
2	Alfalfa before and in bloom, -or- Sweet clover before bud and in bloom, -or- Red clover, -or- Alfalfa-grass (brome, timothy) before grasses head out -or- Sudan grass (18 to 30 inches), -or- Kentucky bluegrass before heading out, -or- Rye after the very early stage (over 5 in.)	10 to 12 per cent
3	Alfalfa after bloom, -or- Sweet clover at seed ripening stage, -or- Alfalfa, grass (grasses heading out), -or- Sudan grass (over 30 inches), -or- Clover-timothy, -or- Kentucky bluegrass headed out, -or- Timothy before bloom.	14 to 16 per cent
4	Kentucky bluegrass after bloom, -or- Mixed grasses at haying time, -or- Timothy in bloom and in seed.	18 to 20 per cent

In this table the arrangement within each group is approximately according to the protein content of the crop, with the one highest in protein at the top. This fact may be given consideration in deciding on the proper protein level in the ration.

Naturally there is some variation in the amount of protein in various crops depending upon the fertility of the soil; the grasses particularly may vary considerably.

I. Amount of Grain to Feed to Cows on Pasture

Feed one pound of grain for every four to eight pounds of milk produced. The higher the milk production, the more nearly cows are fed as during winter, when not on pasture. In any event, cows should be fed enough grain to prevent them from running down in flesh.

FEED BUYER'S GUIDE

A guide that will suggest which one of several feeds has the most value at the prices you have to pay.

DIRECTIONS

How to use the table to get the most feed value for your money

A. Put the local price per ton in column 3.

B. Subtract that from the opposite number in column 2. Put remainder in column 4.

C. Whichever feeds show the biggest difference below the figures in column 2 are the cheapest.

In the example at the right the local price of ground corn was $22 a ton. This subtracted from $30 leaves $8. With ground barley, the local price of $24 subtracted from $28.50 leaves $4.50. In the case of ground oats, $22 from $25.50 is $3.50. Corn, then is the cheapest feed of the 3 at this time or in this particular locality.

This does not mean that you should use only one feed in a similar case, but it does show which feeds are the cheapest. These figures are only approximately correct.

*Cost of grinding farm-grown grains should be added to the market price.

	1 Relative feeding value on base of 100	2 Relative value with corn at $30 a ton	3 Put your local market price per ton below*	4 Comparative saving. Subtract figures Column 3 from 2
Example	Per cent	Dollars	Dollars	Dollars
Corn, ground	100	30.00	22.00	8.00
Barley, ground	95	28.50	24.00	4.50
Oats, ground	85	25.50	22.00	3.50
For Your Use				
Corn, ground	100	30.00		
Corn-and-cob meal	90	27.00		
Barley, ground	95	28.50		
Oats, ground	85	25.50		
Rye, ground	95	28.50		
Hominy feed	100	30.00		
Beet pulp, dried	90	27.00		
Molasses, cane	80	24.00		
Wheat bran	85	25.50		
Wheat middlings	90	27.00		
Dried brewers' grains	95	28.50		
Malt sprouts	85	25.50		
Gluten feed	115	34.50		
Dried distillers' grains	120	36.00		
Linseed meal	140	42.00		
Cottonseed meal	140	42.00		
Soybean oil meal	140	42.00		
Gluten meal	140	42.00		
Alfalfa hay	65	19.50		
Clover hay	60	18.00		
Soybean hay	60	18.00		
Mixed hay (clover-Tim.)	55	16.50		
Timothy hay	50	15.00		

Note: The Guide serves best when it is used for picking a feed from several fairly comparable feeds in a group, as listed between the double lines in the table. When choosing between feeds located in different groups, the use of the relative percentage values as given in the first column probably serves best. It is assumed that the feeds are fed in suitable rations to the proper kind of livestock.

Comparative Crop Returns and Costs

	Yield per acre*	Pounds T.D.N. per acre	Bushels or tons equal to corn in T.D.N.	Protein		Pounds T.D.N. per hour man labor	Cost per 100 lbs. T.D.N.
				Per cent of T.D.N.	Pounds per acre		
Corn.....	51 bu.	2,328	...	9.0	210	220	$ .68
Oats.....	43 bu.	956	105	14.7	141	157	1.44
Barley.....	30 bu.	1,117	63	12.6	141	153	1.24
Wheat, winter....	20 bu.	950	49	11.1	105	134	1.49
Wheat, spring....	17 bu.	808	49	11.1	90	108	1.82
Rye.....	17 bu.	780	51	11.1	87	110	1.82
Alfalfa hay.....	2.4 tons	2,472	2.3	20.2	499	242	.63
Corn silage.....	8.4 tons	2,823	6.9	7.1	200	166	.79

*Average yield of 150 farms in S. E. Minnesota Farm Management Service, 1928-1941, inclusive. In computing the average yield of corn, the yields for those years in which open-pollinated seed was used have been increased by 15 per cent to make them comparable with those of the more recent years when hybrid seed was used.

Comparative Yields and Costs of Producing Feed Nutrients*

Crop	T.D.N. Per acre	Cost of T.D.N.	
		Per acre	Per 100 lbs.
	Pounds	Dollars	Dollars
Pasture.....	759	$ 2.80	$ .37
Alfalfa hay.....	2,226	12.85	.57
Clover-timothy hay.....	1,667	10.98	.65
Corn, ear, husked.....	2,273	20.49	.90
Barley.....	921	14.02	1.52
Oats.....	843	13.46	1.60

*In computing pasture costs, approximately one and one-quarter hours of labor per acre was used annually for fence maintenance, and one hour in driving the cows to and from pasture. This was charged at the rate of 35¢ per hour. Other crop-cost data are averages for Winona County, 1935-1940, from Mimeographed Report No. 125, Division of Agricultural Economics, June, 1941, with labor costs adjusted to a rate of 35¢ per hour.

Reference: #243 - "Farm Business Notes" - Mar., 1943 - Univ. of Minn.

PURCHASE FEEDS THAT ARE BEST BUYS

Corn and wheat are of about equal value, pound for pound. Barley and rye are worth about 95% as much, and oats about 85%.

Linseed meal, soybean meal, ground soybeans, cottonseed meal, gluten meal, or good 34% protein commercial feeds are of about equal value. Gluten feed is worth about 80%, brewers grains 70%, and bran about 60% as much as these feeds.

Good commercial feeds may be used to supplement grain mixtures or may be mixed with home grown feeds. Such feeds should be purchased on the basis of analysis and comparative price.

POSSIBLE SUBSTITUTES IN GRAIN MIXTURES

1. Rye may replace corn, oats, wheat or barley, and may safely make up one-third of the grain mixture.

2. Bran, if you have it, or 16% dairy feeds, may replace some of the farm grains and high protein feeds.

3. Gluten feed, brewers grains or malt sprouts may replace some of the farm grains and high protein feeds.

4. Gluten meal, cottonseed meal, or 34% protein commercial feeds may replace linseed or soybean meal.

With possible shortages in some high protein feeds do not hesitate to substitute feeds mentioned above which you may not have fed in the past.

HAY CROP SILAGE

1. Almost any feed of high moisture content may be preserved as silage.

2. The feeding value of the silage will depend upon the feeding value of the fresh material and the conditions under which it is ensiled.

3. Good silage may be made from hay crops when weather conditions do not permit curing as hay.

4. Under certain conditions, crops such as sweet clover which do not make good hay may be ensiled to good advantage.

5. The quality of hay crop silage may be improved by addition of preservatives such as molasses, acid, or ground corn.

6. Regulation of the moisture content of the green material ensiled is important, even when preservatives are used.

7. Try hay crop silage in a small way and with present equipment before

Reference: Wis. Special Circular - "More Milk in 1943" - Jan., 1943

embarking on an extensive program of ensiling grasses or legumes. This experience may help to avoid expensive mistakes.

Quantity of Preservative to be Added Per Ton of Green Forage

The amounts given, although based on the best available information, are for the most part merely tentative and may be modified as more data and experience are accumulated. Molasses and phosphoric acid are now difficult, if not impossible, to get.

Crop	Molasses	Phosphoric Acid (75%)	Ground Shelled Corn*	Corn-and-Cob Meal	Whey, Dried	Whey Liquid**
Legumes	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Alfalfa, clover, etc.	60	20	150	200	40	400
Soybeans	100	30	200	250	60	600
Legumes & grass mixed						
Clover & timothy, etc.	40	15	125	150	30	350
Grasses & cereals						
Timothy, canary grass, oats, etc.	30	10	75	100	20	250

*Ground barley or other grain may be used instead of ground corn.
**When liquid whey is used, the cut forage should be allowed to dry in the swath for several hours before ensiling.

Ground corn is now the best all-around preservative. If you do not have corn on hand, it is recommended that the first two-thirds to be filled be allowed to wilt for three or four hours. Then use ground corn at the regular rate for the last one-third filling. This will be more economical.

A Few Precautions

1. Have silo in good condition, with tight-fitting doors, and walls clean of old silage remnants.

2. Ensile hay crops while still fairly succulent. In most cases they should be ensiled while in the early bloom stage when they have a dry matter content of 25 to 35%. If too mature, where the chopped material in the silo does not compact well but is quite springy and, therefore, traps a lot of air, it may be necessary to add water.

3. Permit immature and highly succulent crops to wilt for three or four hours in the sun, or longer on sunless days. During continued hot and dry weather, even immature forage crops should be hauled to the silo as soon after mowing as possible.

4. Cut three-eighths inch or one-fourth inch, using sharp knives well adjusted to the shearplate. Short-cut forage of this sort, particularly

if somewhat dry, settles and keeps better. The greener or juicier the forage, however, the longer the cut should be to prevent excessive seepage. Very succulent crops had best be cut about one inch in length. They will keep in the silo even without cutting.

5. Distribute the chopped material uniformly in the silo and tramp thoroughly and evenly over the entire surface.

6. Put some of the greenest and least valuable roughage, perhaps weedy roughage on top, to give added weight for compacting. An additional safeguard is a layer of tar paper which when covered by one to two feet of cut weeds or wet straw rather effectively prevents spoilage underneath.

7. For ten to fifteen days after filling has been completed, take a few minutes each day for tramping especially along the wall. This is to prevent a shrinking away from the silo wall.

Reference: Prof. G. Bohstedt, Univ. of Wis.

ESTIMATING YEARLY FEED REQUIREMENTS FOR LIVESTOCK

The following requirements can be used as general guides by borrowers and supervisors in connection with farm plan development. They must be varied to fit the actual practice to be followed on the farm by each individual borrower. Where quality or quantity of feed is limited, livestock productions should be calculated accordingly.

	Silage (Tons)	Legume Hay (Tons)	Non-Legume Hay (Tons)	Grain* (Bu.)	Protein Concentrate (Lbs)	Miscellaneous (Lbs.)	Bedding (Tons)	Pasture (Days)
Dairy Cow- 200# BF per year	3	2	-	15	---		3/4	150
	3	-	2	15	300		3/4	150
	-	2½	-	25	---		3/4	150
	-	-	2½	25	400		3/4	150
250# BF per year	3	1½	-	35	---		3/4	150
	3	-	1½	35	400		3/4	150
	-	2½	-	35	---		3/4	150
	-	-	2½	35	600		3/4	150
300# BF per year	3	1½	-	45	300		3/4	150
	3	-	1½	45	600		3/4	150
	-	2.5	-	45	300		3/4	150
	-	-	2.5	45	700		3/4	150
Heifer- Yearling	1½	1	-	12	---		1/2	150
Calf- to 1 year	-	1	-	12	---	400#Sk.Milk-3000#Sk.Milk	1/2	150
Feeder Cattle- Grow & Fatten	-	1	-	40	150	1 Ton Corn Stover	3/4	165
Bull- Mature	-	1½	1½	20	100		1	---
Horse	-	1/2	1½	50	---		3/4	90
Sow	-	125#	-	50	150		1/2	150
Market Hog- per 100# gain	-	20#	-	9	10	500# Skim Milk	1/6	40
Ewe	300#	700#	-	2	10		1/10	150
Lambs- Market 4-6 months	-	100#	-	2	---		1/10	90
Poultry- Hen	-	2#	-	1-1/3	15	5#Mt.Scraps-100#Sk.Milk		
100 chicks- to 12-16 weeks	-	50#	-	20	200	50#Mt.Scraps-50#Dr.Milk		
100 chicks- to 5-6 months		60#	-	35	250	65#Mt.Scraps-65#Dr.Milk		

*40 lbs bu. equivalent

Managing the Herd to Increase Production*

See that cows have plenty of fresh water. Warming the water in the stock tank during cold weather will save feed and increase production.

Cows should be turned out for exercise each day, except during very bad weather.

Feed dry cows and bred heifers enough grain to get them in good condition at calving time. This practice will result in an increase of 25 to 30 pounds of butter fat per cow per year.

Good pastures and the production of good roughage on the farm are the keys to greater economy in feeding the dairy herd.

Good milking is important in saving time, getting more milk, and reducing udder troubles. Whether the job is done by hand or machine, clean, fast, complete milking, with proper attention to the health of the udder, is best.

Feeding Herd Sires

It has been found during the last years that bulls should have bright, leafy roughage which would supply them with plenty of vitamins, especially carotene, or vitamin A. Without carotene in their ration, they are unable to produce the sperm and seminal fluid in the epithelial tissue of the generative organs. Many a case of sterility in bulls has been traced to the fact that he has been getting a poor quality of roughage.

It is preferable to feed mixed grass and legume hay rather than either one alone. From 15 to 20 pounds of hay per day (depending on his size) should be fed to a mature bull. Corn silage should be fed not in excess of 15 pounds per day.

Depending on his condition, he may need to be fed from 3 to 5 pounds per day of the same grain mixture that is given to the cows.

If the bull cannot be pastured or staked out on pasture in the summer, he should be fed 15 pounds a day of freshly cut grass or green forage, whatever happens to be in season.

Salt and water should be freely accessible.

Ample exercise should be given to keep him in good physical condition.

*Reference: Wis. Special Circular - "More Milk in 1943" - Jan., 1943

FEEDING AND RAISING DAIRY CALVES

The ability to raise the calves successfully that are born into the herd is of great importance in profitable dairying. These calves will make up the milking herds of tomorrow; thus it is necessary to give them a good start in life and properly "grow them out." Nearly one-fourth of the milking herd must be replaced each year. Raising calves that are sired by a good purebred bull and from the best cows in the herd is a sound way to improve the herd.

Successful calf raising begins with the right feeding and care of the pregnant cow. The greatest growth of the unborn calf, with heaviest demands on the cow, takes place during the last few weeks before birth. Because of this, it is good practice to feed the dry cow liberally and especially to give her good quality hay or pasture. It is harder to raise calves from cows that have been poorly fed than from cows that have been well fed during the dry period.

There are many calf meals and special calf feeds on the market which can be fed more or less successfully to calves. However, these feeds are in general high in price. Under ordinary conditions, the feeding methods mentioned here are more economical than the prepared calf meals and enable dairymen to grow their calves very satisfactorily.

A. Amount of milk for young calves

When feeding milk rather low in fat to a hundred-pound Holstein calf, for instance, we might follow the thumb rule of "one pound of milk per day for each ten pounds of body weight." In feeding milk of higher fat content to feeder calves, a less amount is fed, for instance, five to six pounds of Guernsey or Jersey milk would be safer for a seventy-pound Guernsey or Jersey calf.

B. Feeding methods generally recommended

1. Skimmilk method (See Feeding Schedule on next page)

Excellent calves may be raised with little effort where either separator skimmilk or fresh pasteurized factory skimmilk is available.

Whole milk should be fed according to the schedule discussed above under "A" until the calf is about 3 weeks old. Then a gradual shift to skimmilk can be made, taking about a week to make the change. The amount of skimmilk should be raised gradually, using the weight and condition of the calf as a guide, until about 14 or 15 pounds is being fed daily. Feeding may be continued until the calf is 8 to 10 months old. If the milk available for calf feeding is limited, the younger calves should have their allowance first, after which any surplus may be distributed among the older calves.

If excellent quality legume hay is available, a concentrate ration containing about 8 parts of corn and oats and 2 parts of bran would be suitable. If the hay is of poorer quality, replace 1 part of the corn or oats with linseed or soybean oil meal.

B. 1. Skimmilk Method (Cont'd.)

Feeding Schedule for Calves Receiving Skimmilk

Age Days	Holstein					Jersey				
	Normal Weight	Whole Milk	Skim milk	Grain	Hay	Normal Weight	Whole Milk	Skim milk	Grain	Hay
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
Birth	89					55				
2		With dam					With dam			
3-14		10					6			
15		10	1	1/4	1/4		7	1	1/4	1/4
16		10	3	1/4	1/4		6	2	1/4	1/4
17		8	4	1/4	1/4		6	2	1/4	1/4
18		6	6	1/4	1/4		5	3	1/4	1/4
19		4	8	1/4	1/4		4	4	1/4	1/4
20		2	10	1/4	1/4		2	6	1/4	1/4
21			12	1/2	1/4			9	1/4	1/4
22-30	121		12	1/2	1/2	76		9	1/2	1/4
31-60	157		14	1	1	105		12	1	1/2
61-90	200		14	2	1½	140		12	1½	1
91-120	249		16	2½	2	174		12-16	2	1½
121-150	302		16-20	3	2½	222		16	2½	1½
151-180	349		16-20	4	3	260		16	3	2

Reference: Eckles' "Dairy Cattle and Milk Production"

B. 2. Dry Rations With Little Milk

Good calves may be raised by using only limited amounts of whole milk, shifting the calf to a dry ration at an early age. The use of dry rations has the advantage of reducing the care and labor required in feeding calves and provides a more uniform diet than is often given the calf when it is attempted to use fluid substitutes for milk. One should not expect quite the rate of growth nor the sleekness of coat in the calf raised on a dry ration that may be obtained with a ration including liberal allowances of fresh skimmilk. However, very good calves may be raised by the dry ration method and it offers many dairymen a plan suited to the conditions of their market outlet.

Milk feeding may be discontinued at 30 days of age if the calf has been properly started on a suitable ration and is consuming sufficient amounts of the dry feeds to support it. There is little to be gained by attempting to remove the milk before the calf is 30 days old. Only 250 to 300 pounds of whole milk will be needed by the calf during the first 30 days and the small amount of milk saved by earlier withdrawal will seldom pay for the accompanying trouble and the cost of substitutes.

The calf that is to get along without milk at an early age needs a ration that includes easily digested protein, some of which is of animal origin. In addition to the common grains and mill feeds, one may use dried or powdered skimmilk, soluble blood flour, or even tankage as a source of animal protein. The cost of dry skimmilk or soluble blood flour is comparatively high, hence it is desirable to make most efficient use of these feeds. They are most needed by the calf during the period immediately following the removal of fluid milk from the diet and while the total food intake is small.

It is important to teach the calf to eat both hay and dry concentrates at an early age if the fluid milk is soon to be removed from the diet. This can be accomplished by placing the feeds before the calf when it is ten days old. A little of the grain mixture may be placed in the milk feeding pail, after the allowance of milk has been drunk, where the calf will find it in its efforts to secure more milk and thus be encouraged to eat grain. If the milk allowance is held somewhat below the calf's appetite and capacity, it will have sufficient hunger to be interested in other feeds.

In order to furnish a sufficient supply of vitamins A and D to protect the calf properly from deficiency diseases and to stimulate growth, it is important to feed good quality, leafy, sun-cured legume hay. The calf should be encouraged to consume one pound of the hay daily by the time it is 8 to 10 weeks old and it should be allowed as much hay as it will consume at all times. After the calf has been gradually weaned from fluid milk and its total feed intake has increased sufficiently, the proportion of special supplement, such as dry skimmilk or soluble blood flour, may be reduced.

B. 2. Dry Rations With Little Milk (Cont'd.)

Where no special premium is received for the market milk, it may prove fully as economical to feed whole milk until the calf is eight to ten weeks of age and avoid the purchase of any special supplemental feed. If the calf is carefully managed so that it is consuming 1.0 to 1.5 pounds of hay and a like amount of grain by the time it is eight to ten weeks of age, the milk may be gradually removed, continuing the calf on only the hay and grain. A total of 400 to 500 pounds of whole milk may be made to last until the calf is eight to ten weeks of age, by limiting the daily allowance to 7 to 10 pounds. Vigorous Holstein calves will consume the larger daily allowance but may be shifted to a dry ration somewhat earlier than lighter weight calves such as Guernseys and Jerseys, which may be fed a smaller daily amount but continued on a whole milk diet two to three weeks longer. Under such conditions a mixture of equal parts of corn, oats, bran, and linseed meal, with 1.0 per cent salt, has proved satisfactory.

Sufficient drinking water should be supplied to the calf receiving only a dry ration.

Silage is relished by calves and small amounts (only a double handful) may be offered when the calf is three months old. It is a bulky feed, however, and it is low in protein, hence the amount fed should be limited so that the amount of hay consumed by the calf will not be reduced as the calf needs the protection of the vitamins and minerals supplied by the legume hay.

Unthriftiness or stiffness may be due to improper feeding and management or to a lack of vitamins A and D. Correct the ration by using high quality, leafy, sun-cured hay and include suitable concentrate feeds. If low quality hay must be used, it may be necessary to add cod-liver oil to the concentrates. Two per cent by weight may be included in the concentrate mixture, or 1 to 2 ounces, according to the size of the calf, may be poured over the daily allowance of grain.

3. Feeding Schedule

Starting at about ten days of age, small amounts of both hay and the concentrate mixture should be offered at each feeding time. Only a few ounces will be eaten at first, but a gradually increasing amount should be consumed. In round numbers, the calf will eat only slightly less than as many pounds of each hay and concentrates daily as its age equals in months. When the level of consumption reaches three to five pounds of concentrates per day, it may be more economical to limit the calf to such an amount, encouraging it to consume more hay.

B. 3. Feeding Schedule (Cont'd.)

The following mixtures are suggested for feeding at the ages indicated:

a. First 40 days - (Gradually remove whole milk during last 10 days)

Dry skimmilk	125 pounds
Meat scraps or tankage	65 "
Ground yellow corn	510 "
Wheat bran	150 "
Linseed meal or soybean meal	150 "
Salt	10 "
	1010 "

b. 40 to 120 days of age

Dry skimmilk	65 pounds
Meat scraps or tankage	30 "
Ground yellow corn	555 "
Wheat bran	175 "
Linseed meal or soybean meal	175 "
Salt	10 "
	1010 "

c. 120 to 180 days of age

Ground yellow corn	600 pounds
Wheat bran	200 "
Linseed meal or soybean meal	200 "
Salt	10 "
	1010 "

Approximately the following amounts of feed will be consumed during the first six months by the average calf raised by the dry ration method: Whole milk 300 to 500 pounds; hay, 350 pounds; concentrates, including dry skimmilk, 450 to 500 pounds; dry skimmilk, 50 to 75 pounds.

Reference: I. W. Rupel and G. Bohstedt - University of Wisconsin

DAIRY CATTLE PURCHASING RECOMMENDATIONS

The proper selection of dairy animals under conditions that make their purchase profitable, directly affects the success or failure of the dairyman's farm business. Before deciding upon the purchase of additional dairy cattle, farmers should consider carefully, present conditions and future outlook in connection with price and availability of feed, price of butter fat and type and price of livestock available for purchase. Intelligent consideration of these factors will enable the farmer to decide better whether it will be profitable for him to purchase additional animals now and if so, what age, type, etc. might prove most profitable.

Factors which determine what can profitably be paid for individual animals might include: Production record, breeding, type, freedom from disease and physical defects, age, size, etc. Ample consideration of all factors makes it quite clear why a reasonable price under some conditions might be entirely out of line under different conditions.

I. Age of animals to buy

A. Should young stock or mature cows be purchased? The advantages to be gained, under many conditions, by buying more young stock and fewer high priced cows might include:

1. Small investment --- less financial risk -- price may be more in line with actual value.

2. Young stock will increase in value.

3. Higher quality foundation livestock can be obtained at prices not prohibitive.

4. Less likely to get animals infected with disease, udder trouble and breeding trouble.

5. Less likely to get "known culls, low producers, etc."

B. What age young stock should be purchased? The answer to this question depends upon feed conditions, housing conditions, ability of the farmer to grow young stock properly, etc. The following general guide may be of some value in deciding relative value of calves and heifers at different ages.

Age	Relative Value
Heifer Calves-----	Veal price or slightly above depending on dams, production, breeding, etc.
6 mo. Heifer------	Not over 75% of yearling heifer cost.
Yearling Heifer---	Not over 50% of freshening heifer cost.

(Note: Under normal conditions it costs about $25.00 a year to feed a heifer from 6 months of age to freshening age (24-30 months).)

C. What age cows are most profitable to buy? It is usually best to buy young cows (under 5 years) because:

1. They are less likely to be infected with disease, udder trouble, breeding trouble, etc.

2. They have a longer life expectancy, allowing more years of production and sufficient time to grow replacements. (This permits sale of original animal at good price as a springer before excessive age makes this practice impossible.)

3. They are more adaptable to changed feed and management conditions.

D. How can age of cattle be determined? See age chart and sheet attached -- cows should never be purchased or appraised without actual inspection of teeth to determine age.

II. Important points to be observed when selecting individual animals

A. Breed

Consider the type of milk market you have, the type of feed available and the kind of care that will be given the animal. The larger breeds usually are more rugged and can utilize a larger amount of good roughage than the smaller breeds. Special markets are sometimes available for a certain type of milk. The important thing to remember is that good cows of any breed will return more income than average or poor cows of any other breed. It usually is best to select one breed and use a sire of that breed as that eliminates breed mixture, improves herd uniformity and increases sale value of surplus stock.

B. Size and type

Other things being equal, the medium to large cows of a breed are preferred to the smaller cows. Pick cows which have good capacity for feed, that are strong thru the heartgirth and reasonably straight over the top and level over the rump. Udders should be large and well attached with teats well placed and of medium size. Average ease of milking is desired. (Avoid animals with narrow heads and muzzles, usually they are poor feeders.)

C. Production Standards for cattle to be purchased

1. Cows in milk should be under 5 years of age with a record of not less than 200 pounds of butterfat per year or indicate capability of at least that production. If no records are available on cows being considered for purchase, inquiry should be made regarding the animal's past performance. This will help to determine as accurately as possible her probable production considering type of feed and care she has had.

A much higher native producing ability might be found in a 200 pound cow, whose low production was due to poor feed and care, than in a 300 pound cow which had been well fed and efficiently managed.

Suggested Price Range for Cows 5 Years of Age or Under
(Assuming factors other than production remain constant)

If a cow with 350# butterfat record is worth 100%
a cow with 300# butterfat record is worth approximately 80%
a cow with 250# butterfat record is worth approximately 65%
a cow with 200# butterfat record is worth approximately 45%

2. All heifers or calves should be sired by purebred bulls whose dam produced over 350# butterfat and wherever records are available the dams of such heifers should have produced over 250# butterfat.

D. Defects, diseases, etc. to be avoided

1. Purchase only from Bangs-free herds, (preferably certified), demand that the seller comply with the law regarding the test card, etc. (See data from Division of Sanitation.)

2. Shipping fever (Hemmorhagic Septicemia) should be guarded against by vaccination where animals are shipped or trucked in or when the disease is prevalent.

3. Udder troubles

a. Mastitis or infection of the udder -- (difficult to determine without laboratory tests). Examine udder carefully, if one of the rear quarters is larger than the other rear quarter, or one front quarter larger than the other, you should be suspicious of mastitis. Handle each quarter carefully -- after milking, watch for hardened area.

b. Reject cows that have defective quarters, hardened areas in any part of the udder, or that give bloody or stringy milk.

c. Avoid cows having a pendulous, loosely attached udder as it is more subject to injuries than the snugly attached udder.

d. Check teats for extra openings. Sometimes there is an opening near the base or on the side of the teat. This is objectionable.

e. Avoid cows that leak milk or milk too easily -- there is danger of such cows picking up udder infection.

4. Breeding trouble -- purchase cows that are regular breeders.

Avoid animals that have a history of difficult breeding, retrained afterbirth, or abnormal discharges.

5. Protrusion of the rectum or vagina -- This condition is usually noted when the animal is lying down. May cause considerable difficulty as the animal gets older.

6. Avoid animals showing vaginal discharges, labored breathing, unthriftiness, scouring, scabby areas on the body or any abnormal conditions.

7. Blindness -- The cow that is blind in both eyes should not be purchased. Cows blind in one eye should be bought at a reduced price.

8. Feet and legs -- Very crooked and weak hind legs are undesirable and indicate weakness. Cows with weak pasterns are at a disadvantage on pasture.

9. Suckers -- This bad habit is often difficult or impossible to detect upon casual observation. Avoid any cow or heifer that has its nose punched for a ring, the tongue slit or that is wearing an anti-suck device.

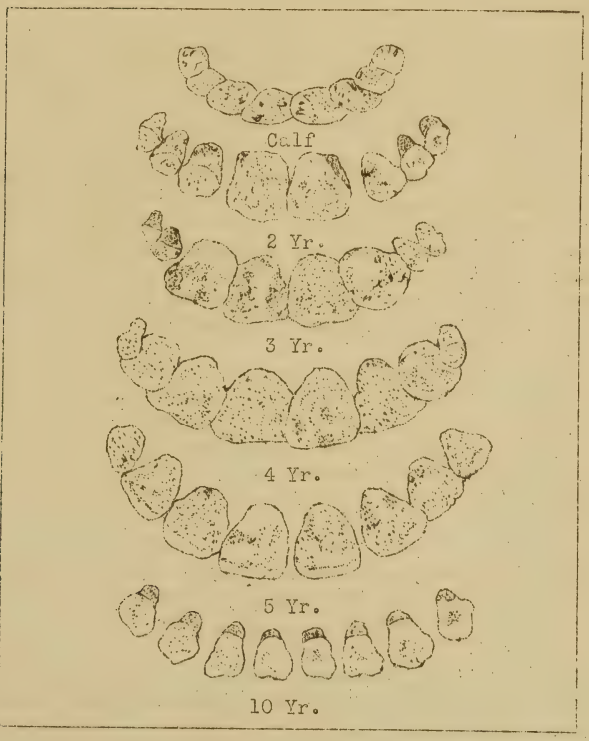
10. Kickers or nervous cows -- Fence jumpers. Chain or rope marks at the hooks or flanks or over the loin may indicate a kicker. Shifting, nervous action of the cow as she stands in the stall may indicate her characteristics. Avoid cows wearing or bearing marks from wearing anti-fence jumping devices. They may cost more in fence building materials and wasted time than they return in production.

It is good business to have a smaller number of sound, healthy productive animals headed by a pure-bred sire from ancestry of high production rather than a larger number of inadequately fed low producers.

WE CAN TELL A COW'S AGE BY HER TEETH

The pictures below show the changes in the teeth from a calf to 10 years old.

Note that the heifer sheds two of her "Milk teeth" when 2 years old and gets in their place two big new permanent teeth. When 3 years old, she gets two more big teeth, and two more each year until at 5 years she has a "full mouth" or all large teeth. After 5 years the teeth gradually become smaller and more like pegs. The last set below are of a 10-year old cow.



When buying a heifer or cow, better look at her teeth.

ARTIFICIAL INSEMINATION OF CATTLE

Artificial insemination is not new. It is reported that certain Arab horsemen made use of it some 600 years ago. As long as 150 years ago it was demonstrated conclusively that the mere introduction of the male secretions into the reproductive tract of the female will produce young in the absence of natural matings.

In more recent times, Russia has been a leader in demonstrating the usefulness of artificial insemination with cattle. English workers have also made use of this tool. Denmark was the first country to set up artificial breeding rings in which the bulls were kept at a central location and the semen collected there and carried out to the different herds having cows to be bred. New Jersey has completed over five years of successful operation of this type of breeding association, and two such rings have been in operation in Wisconsin since April of 1939. By autumn of 1943, approximately 60,000 cows in 31 Wisconsin counties will be enrolled.

A. Method of Organization

1. As organized in Wisconsin, such an artificial breeding ring is a cooperative organization of a number of dairymen interested in the improvement of their herds through the use of better sires than they could afford to own individually.

2. Meetings are held to acquaint the interested dairymen with the problems involved and to sign up members. A temporary committee is elected or appointed to contact the breeders and sign up additional members. When a sufficient number of cows are signed up, permanent officers and a board of directors are elected by the members. These officers are responsible for the management of the association and its successful operation.

3. While the first rings were set up on the basis of single counties, we now have one association servicing five counties from one central laboratory. Where facilities for transporting semen are adequate, several counties with a veterinarian located in each county could well operate from one central laboratory. This type of organization offers the opportunity to materially reduce overhead costs.

4. A qualified veterinarian is hired, suitable sires are selected, central laboratory facilities and bull quarters are set up, and the ring is ready to operate.

5. When a member has a cow or cows in heat, he calls the veterinarian. The animals in heat are left in the barn. The veterinarian collects his samples from the proper bulls and inseminates all the cattle that have been reported in heat.

6. The service fee of $5.00 entitles the owner to three services for any animals that require this number.

B. Advantages of an Artificial Insemination Association

1. It provides the advantages of a large herd for the smaller herd owner in securing services of superior sires.

The smaller herd owner is usually at a great disadvantage in securing superior sires for the improvement of his herd. By joining an organization of this type, he is able, at a reasonable cost, to secure the services of good bulls.

2. Offers a means of sharing the risk in proving young bulls.

Even though the best bred young bulls may be used, experience tells us that some of them do not come up to expectations.

In a ring of this type, any one breeder need have only one or two daughters of any one unproved bull, and his herd need not be ruined if a bull proves poor. Where an untried bull is used on a whole herd, the owner often finds his crop of calves to be inferior.

3. Large number of daughters for proving bulls.

While we call a bull proved when he has five or ten daughters with records in one herd, we know that a large number of daughters with records made in different herds under different conditions offers much better proof of a bull's worth.

4. Proving sires at a younger age.

Experience teaches us that bulls are usually 7 to 9 years old before we have enough information to evaluate their breeding ability In a ring of this type, bulls can be proved when they are 5 to 5½ years old, while the good ones still have many years of usefulness ahead of them.

5. Better sires at no increase in cost.

Cost accounting records show us that it costs from $50 to $60 to feed a bull for a year. In an association of this type a herd of 12 cows may be serviced for $60.

6. Eliminates danger of having a bull on the farm.

Many dairymen count this a very important advantage. Bulls are always potentially dangerous animals; and especially where there are children on the farm, this is an important consideration.

7. Disease control.

Only clean, healthy bulls are used, and, inasmuch as no cows are bred direct, there is not the danger of spreading infection from

one cow to another that we sometimes encounter in direct service.

8. Veterinary advice.

In the course of the veterinarian's visits to a farm, he sometimes sees things that the farmer would not recognize until they become serious. The old saying, "A stitch in time saves nine", applies in the early recognition of livestock ailments. Then, too, in inseminating cows, the veterinarian may find animals that will never be breeders or that need some treatment to get them functioning properly. While he does not have time to do the veterinary work on the farms of his members, his advice often saves a breeder considerable grief.

9. Pregnancy exams.

The veterinarian will make pregnancy examinations of animals that have been bred. Occasionally cows are bred, and although they do not conceive, never come back in heat. The veterinarian will pick up these cases, and if they are not likely to become breeders, they may be disposed of. In the case of all cows in the herd, it is worth a good deal to the peace of mind of the owner to know rather early that his cows are safely with calf.

10. Improved cattle in a community will attract buyers.

Buyers will be attracted to communities that are using the type of bulls that will be in service in a well organized artificial insemination ring.

Reference: Dr. E. E. Heizer, University of Wisconsin

A NEW WAY TO CLEAN THE MILKING MACHINE

Rinsing the machine with cold water is not necessary if wetting agents are used in cleaning milking machines. These materials will do a good job, and their use will save time over the usual methods.

Wetting agents from your grocer -- Dreft and Swerl

Wetting agents in bulk from your creamery or milk plant -- Mp-189, Nacconol, Arctic Syntes M Beads, Neosuds.

No attempt is being made to name all wetting agents, merely some of those which have come to our attention. These products are not soap.

The operation is simple:

1. Make a pail full of suds in water 120° F. (just too warm to immerse your hand) using about one heaping tablespoonful to the pail.

2. After the milking is completed, suck the entire pail full of suds thru the unit. Shake the bucket so that the inside surface of the bucket will be splashed. The solution can then be used to clean the other units. The seal-rubber rim and outside of the parts should be washed with a wooden handled soft bottle brush.

3. This should be followed by sucking a pail of boiling water thru each unit.

4. Inspect tubes, hang them up to drain and dry.

5. For added assurance, run a pail full of chlorine solution thru machine just before milking.

When using war emergency rubber, the service man should be consulted as to whether boiling water may be used.

The milking machine is not fool proof. The working of the machine, its state of repair and cleanliness depend to a large extent on the skill and effort of the operator.

A CREAM SEPARATOR CAN BE WASHED IN 2 MINUTES BY THE NEW METHOD

(It must be understood that the machine is clean before separation is started.)

THESE FOUR STEPS MUST FOLLOW AS RAPIDLY AS POSSIBLE

1. After all milk has left the supply tank, shut off power or stop turning.
2. Rinse supply tank with a cup of warm water then shut off faucet
3. Add one pint of warm water or skimmilk directly over the float or enough to clear the cream from the machine.
4. Place about a tablespoonful of a wetting agent in the supply tank, then pour in a pail (be sure it is a full pail) of warm water (120° F.). See that the wetting agent is dissolved, and let this run thru the separator while the bowl is running down. While the solution is running from the machine, with soft brush brush the supply tank inside and out, the outside of the cream and skimmilk spouts as well as the frame of the separator.

5. Pour the water which has come thru the machine into a dish pan.

6. Dismantle the machine. The supply tank, spouts, float and inlet seldom will need further cleaning, place these in supply tank. (Note: There may be some foam in these parts when they are removed but on inspection usually it will be found to be foam of the cleaning solution--not milk or cream.)

7. On opening the bowl as a rule you will find discs perfectly clean, there may be a slight smear on an occasional disc, set the discs in the water and run the brush down the hole several times pumping the water between the discs. The flow caused by the brush will clear the discs. Shake the discs apart for inspection, then place these in supply can.

8. The slime on the rest of the bowl parts will be soft and easily washed off with the brush, it requires no scouring, the soft brush will do the work nicely.

9. After all parts are in the supply can, pour a kettle of boiling water over all parts, drain and allow to dry.

NOTE 1: The cleaning solution can be used to wash pails, cans and other equipment. There is no scouring needed if surfaces were clean before using.

NOTE 2: The brush referred to, is known as a bottle brush, the size for your job depends on the size of the separator.

NOTE 3: Wetting Agents Tried:

From Your Grocer:
Dreft -- Proctor & Gamble
Swerl -- Swerl Products Co.

Creameries can supply the following:
Nacconol -- National Soap Company
M. P. 189 -- Du Pont
Neosuds -- J. B. Ford Company
Arctic Syntex M Beads -- Colgate-Palmolive-Peat

These Wetting Agents Are Not Soap

ORDINARY WASHING POWDER will not give the results described.

No attempt is being made to name all wetting agents, merely some of those which have come to our attention. Other products will be offered you as time goes on, you will have to judge their merits by comparison. Even those named here have their champions. Their chief merit is that greasy surfaces can be cleaned without scouring and that they rinse freely.

Reference: A. W. Rudnick, Extension Dairyman, Iowa State College

GOOD MILKING PRACTICES AND CARE OF THE MILKING MACHINE

Follow Good Milking Practices

Good milking, by hand or machine, is clean, fast, complete milking with careful attention to the condition of the udder.

It saves time, gets more milk, reduces udder troubles.

For best results with a milking machine:

1. Keep in mind that heifers freshening with their first calves are usually easiest to train to machine milking. Older cows in good flow of milk respond next best.

2. Before the machine is put on a cow, check each quarter of the udder for soreness or swelling. Milk cows, suspected of garget, after clean cows have been milked.

3. Be sure the milk is "let down" before attaching the teat cups. Washing with warm water or lightly massaging the udder and teats helps to get the milk down.

4. Attach the machine soon after the milk is let down.

5. Milk "leakers" -- if free from garget -- first.

6. Remove the machine as soon as the cow is milked out. Except for an occasional cow, it should not be left on more than three or three and one half minutes. Some cows will milk out in one and one-half to two minutes.

7. Strip cows right after the machine is removed.

8. Do not frighten or irritate cows, especially at milking time. To do so may cause the milk to be held up.

9. Treat chapped and sore teats with vaseline or some other healing ointment.

10. Establish a regular routine of feeding, milking and care, and follow it each day. Cows become accustomed to a certain routine and are upset by sudden changes.

11. Keep machine in good repair and see that pulsations or suction strokes are uniform at all times. Operate machine at speed recommended by the manufacturer - 48 to 50 suction strokes per minute is usually about right. Maintain the recommended vacuum.

Care of the Machine

The machine must be kept clean if the keeping quality of the milk is not to be injured.

Following are essential steps to take in properly caring for the milking machine:

1. Immediately after each milking, draw a pailful of clean water through each unit. Dip cups in and out of the water.

2. Hang cups in a rack and fill with a solution of lye.

3. Wash and sterilize milker pails and heads at once after each milking. Place on a rack to dry.

4. Just before milking, drain lye solution from the cups and discard it. Rinse cups with water of drinking quality.

5. Take milker units apart once a week. Thoroughly wash and brush all parts. Replace worn parts. Reassemble, place in rack, and fill with lye solution.

6. With short-tube machines, after each milking remove rubber parts, rinse in cold water, and place in a solution of lye. Use a quantity of the solution but once. Wash, sterilize and dry metal parts. Rinse lye from rubber parts before using them.

7. Wash long air hoses occasionally to keep them free from obstructions.

8. Clean pipe-lines every spring and fall, and any time milk has been drawn into the line.

9. Be regular in following this program if you want good milk.

How to Prepare the Lye Solution

Slowly pour the contents of a 13-ounce can of lye into a gallon of cold water in an earthenware jar or crock; stir as lye is being added and until it is all dissolved. Don't spatter it on yourself or your clothes. When cold, put in a glass or earthenware container (jug), cork. Label "Poison". Keep it out of reach of children.

The solution with which teat cups and milk hoses are to be filled is made by adding six ounces of the above stock solution to a gallon of water (a half-pint milk bottle, which holds eight ounces, is a convenient measure).

Reference: Wis. Special Circular - "Good Milking Practices and Care of the Milking Machine" - April, 1943

WASHING DAIRY UTENSILS

The necessary steps in washing utensils are these:

1. Rinse utensils in cold or luke warm water because hot water makes the milk stick to them.

2. Wash in a solution made by dissolving a dairy washing powder at the rate of one or two tablespoons for two or three gallons of fresh hot water (as hot as the hands can stand and in which nothing else has been washed). The exact amount of washing powder needed will depend on the kind of washing powder used and the hardness of the water. Avoid the use of soap and soap powder as it may not rinse freely and thus leave a greasy film. Use a brush in washing because it cleans itself in use and can be kept clean.

3. Rinse the utensils in scalding hot water.

4. Shake to free them from excess water. Do not wipe them.

5. Invert all parts on a clean rack in a clean place away from flies.

All water used for washing and sterilizing should be pure and free from contaminating bacteria. Write to the State Board of Health if you want your water tested.

6. Sterilize the utensils. This is necessary because utensils may appear clean and still contain many bacteria. Two main methods of killing bacteria are heat and chemical sterilization. The U. S. Public Health Service requirements for methods of sterilization are:

   a. Expose for at least 15 minutes to at least 170° F. or at least 5 minutes to 200° F. or over in a steam cabinet.

   b. Exposure to a jet of steam for at least one minute, or

   c. Exposure to a chlorine solution of approved strength for at least two minutes.

Where a steam cabinet or an ample supply of real hot water is not available, as is the case on most farms, the chlorine solution should be used at a strength of at least 100 parts per million. Satisfactory concentrated compounds containing active chlorine may be procured from local dairy plants or general supply stores. Dilute solutions containing 100 parts chlorine or more per million parts of water should be prepared according to the directions on the package which are based on the chlorine strength of the material used. Any chlorine rinses should be applied only just before using the utensils so that such solutions do not remain in contact with the metal surfaces for long periods.

The construction of dairy utensils is important. Well made utensils with rounded smooth surfaces are much easier to keep clean. It is next to impossible to properly clean pails and cans that have open seams, rough

solder or that are rusty. Milk lodges in such places and provides breeding places for bacteria. Some kinds of metal affect the flavor of milk. For this reason dairy utensils should be well tinned. When the tin wears off so that the bare steel or iron is exposed, the utensils should be discarded or retinned.

If it is necessary to use a strainer, the best type is one which has the single service cotton pad. These pads should be discarded after each milking. Cloth strainers which are used more than once are very objectionable because they are difficult to clean and sterilize. Obviously they should not be used. Straining does not reduce the number of bacteria in milk. Unless straining is done in a very careful manner with a sterile strainer, it will add large numbers of bacteria to the milk and lower its quality.

Reference: University of Wisconsin, Dairy Department

DISINFECTING AND WHITEWASHING

Clean the barn thoroughly, sweeping dust and cobwebs from the ceilings and walls. All decayed and rotten boards should be removed. If tuberculosis or other infectious disease has been present, soak with water the hardened particles of filth and manure so they can be removed. Scrub all surfaces with a solution of one can of lye to ten gallons of water using a long handled stiff brush so that the solution does not come in contact with the hands. The barn should also be sprayed with a good disinfectant.

Whitewash formula:

1. Mix 25 lbs. of hydrated lime in 12 gallons of water and add 1 gallon of buttermilk.

2. Mix 50 lbs. of hydrated lime with 8 gallons of boiling water, add 10 lbs. of common salt and 1 lb. of alum, dissolved in 6 gallons of boiling water. Stir well and add 5 lbs. of cement.

3. Slake 10 lbs. of quick lime in 2 gallons of water, cover and let stand for an hour, then add sufficient water to bring the mixture to the thickness of thin cream.

4. Factory whitewash:

   A. Beat up a half pound of rye flour in a pint of cold water, then add 1 gallon of boiling water.

   B. Dissolve half pound of common salt in 2 quarts of hot water.

   Mix A and B, then stir this into a solution of 10 lbs. of quick lime slaked in 2 gallons of water.

5. Weatherproof whitewash. Slake 62 lbs. of quick lime in 12 gallons of hot water and add 2 lbs. of salt and 1 lb. of zinc sulphate dissolved in 2 gallons of boiling water. To this mixture add 2 gallons of skim milk and stir well.

6. Slake quick lime with water and add sufficient skim milk to bring the consistency to that of thin cream. To each gallon add 1 oz. of salt and 2 oz. of brown sugar dissolved in water. The germicidal valve may be increased by adding one-fourth pound of chloride of lime to every 30 gallons of wash.

7. Slake quick lime with enough water to make a thick paste. While it is slaking, add a pint of melted lard or other grease and a cup full of salt to each bushel of lime. Add enough water to bring the solution to the consistency of thin cream and strain through burlap.

8. An ounce of alum to a gallon of whitewash will prevent it rubbing off. A pint of molasses to five gallons of whitewash makes the lime more soluble and causes the whitewash to penetrate further into the wood. A pound of cheap bar soap dissolved in a gallon of water and added to 5 gallons of thick whitewash will give it a glass-like oil paint.

9. There are on the market preparations that make excellent whitewash and that are not expensive. In many cases these are better than home made mixtures which may be poorly prepared.

Reference: University of Wisconsin, Dairy Department

CARDINAL PRINCIPLES ON MILK HOUSE CONSTRUCTION

A. LOCATION

1. Convenient to barn -- so that the milk from each cow can be strained and cooled in a milk house immediately after milking.

2. Should be on clean side of barn -- away from cowyard, away from silo (should not be connected with silo feed room) -- provide good drainage; develop gravel turn around and as much grass area as possible to avoid dust and mud.

3. Can be attached to barn providing door to milkhouse is 6 to 8 feet away from door leading to barn. Doors should be self-closing.

4. Covered passage between barn and milk house or porch at side is desirable. A good arrangement is to locate milk house 6 to 8 feet away from barn and extend milk house roof over passage between barn and milk house.

5. Locate so that door leading to milk house will open out of dairy unit -- not making it necessary to carry milk through horse barn, silo room, etc.

6. Consider future modernization or alterations to barn, convenient yard arrangement, water supply, sewage disposal, prevailing winds as related to cowyard, horse barn, hog house, etc.

B. PLAN

1. Consider market requirements and possible change to different market.

2. Decide upon type of construction -- masonry or wood.

3. Minimum size must provide space for cooling tank, water heater, washing, storing of utensils and any other necessary dairy equipment.

4. Minimum size for one-room milk house - 10 x 12 feet
Minimum size for two-room milk house - 12 x 16 feet

5. Locating door in corner or at side close to cooling tank will provide most usable floor area.

6. Well or pump should not be located in milk house, unless compact electrical unit is used. Space required for this equipment must be allowed in planning house.

C. CONSTRUCTION

1. Foundations of concrete 8" thick, extending 3'-6" to 4' below grade line. Concrete foundation wall to extend 1'-5" above floor line when wood construction is used to accommodate installation of cooling tank. Provide anchor bolts.

2. Floor line approximately 2 to 6" above barn floor is desirable if site will permit.

3. Covered passage floor or loading platform 2 to 3" below milk house floor. Loading platform 6 to 8" above driveway.

4. Wood construction - 2 x 4 or 2 x 6 studs, 2 x 6 ceiling joist, 2 x 4 rafters, 24 inches o.c. Single boarding on exterior and interior walls -- boarding on exterior walls must be watertight. Interior walls must have moisture barrier paper applied to studs before inside sheathing is applied. Interior lining dry seasoned material to avoid shrinkage.

5. Dry wood shavings can be used to insulate walls and ceiling -- must be packed in side walls -- 6 to 8" thick at ceiling.

6. If masonry is used, light weight concrete blocks are preferable because of their insulating value. Lightweight concrete blocks should have openings in blocks filled with material from which blocks are made to increase insulating value. Concrete foundations should extend 6" above floor line or where wall contacts earth 6" above grade line. Waterproof interior walls with cement plaster coat. Use reinforced lintels over openings. Ceiling and roof construction same as for wood frame.

7. Window area ten per cent of floor area -- provide for storm sash and screens. Glass in milk house door recommended to provide light and visibility in passing in and out of milk house.

8. Vent duct with damper to start at ceiling line and connect with roof vent -- should contain not less than 100 square inches and fitted with a screen.

9. Gable roof preferable -- easier to insulate and ventilate. Provide louvres in gable and screened opening in ceiling of passage way types.

D. COOLING TANK

1. Capacity of tank -- large enough to hold both evening and morning milk at peak milk flow. Place evening milk at cool end of tank (water inlet) when cooling morning milk. Insulated tank preferable

2. Size of concrete tanks 32" wide (inside dimension) -- length 24" for first pair of ten gallon cans, increasing length 18" for each pair of ten gallon cans.

3. Top of concrete tank 12" above floor line.

4. Concrete cooling tanks must be separate units -- foundation wall must not be used as part of tank.

5. All tanks should be insulated and have insulated cover.

6. Types of Insulated Concrete Tanks

   a. Water Cooling Only

      (1) Tank placed 5 to 6" away from concrete wall and space at back and end filled with cinders or granular type insulation -- front wall of tank to have rigid type insulation in center of tank wall (1 or 2 inches of insulation).

(2) Two thicknesses of rigid type insulation board placed in bottom of tank, at back and ends, with insulation in center of front wall as in "a". (With this type of tank, insulation can be placed against foundation wall at back and ends.) Rigid type insulation board (Celotex, Insulite, etc.) must be cut to size to fit tank and painted with two coats of hot asphalt.

b. Water Cooling or Mechanical Cooling

(1) 2 to 3" rigid waterproof-type insulation placed in bottom of tank and in centers of all four walls.

E. WATER SUPPLY

1. Automatic pressure system preferable, with pipes underground.

2. Water temperatures too high for cooling with water stored in cisterns or large storage tanks.

3. If possible, overflow from cooling tank should be piped to stock tank. Sump pump or shallow well pump can be used to force water from cooling tank to desired location when necessary.

4. Water should enter the tank in the center at one end about 4" from the bottom, with overflow in center at opposite end. Overflow pipe size 2".

5. Provide water supply connections for wash vats and water heater. Advisable to have all water lines connected with frostproof unit so that water lines can be shut off and drained during extremely cold weather.

F. SEWAGE DISPOSAL

1. Sewage system consists of floor drain and overflow from cooling tank piped to trap on exterior of milk house. From trap, sewage flows to dry well, field drain or filter trench. Dry well should be located at least 100 feet from well. Trap capacity approximately 50 gallons, made similar to kitchen grease trap in house sewage system.

2. 4' floor drain to be located near wash vats, placed 1" lower than floor at walls. Overflow pipe in cooling tank to have coupling at bottom of tank so that overflow pipe can be unscrewed and removed when draining tank. Opening around coupling made large enough to seal with asphalt so coupling can be replaced if necessary.

NOTE: When cooling tanks are to be constructed as a separate unit, they should be located with due consideration of above cardinal principles so that a milk house can be constructed around them at any future time.

Reference: Wis. Circular No. 312 - "Milk Houses for Wisconsin" - Rev. April, 1941

WISCONSIN REGULATIONS

Relating to

THE DIVISION OF LIVESTOCK SANITATION

Inter-State Regulations Governing the Control of Bang's Disease:

All cattle shipped into Wisconsin must be accompanied by an official certificate of health indicating freedom from all contagious, infectious and communicable diseases, including report of official negative Bang's agglutination test made within 30 days prior to entry into the state, except:

1. Female cattle and bulls from Bang's abortion-free accredited herds may enter without a retest when accompanied by an official inter-state health certificate indicating date of last test and accredited herd number.

2. All female cattle and bulls shipped into Wisconsin for resale unless originating in an accredited Bang's disease free herd must be held in quarantine by consignee until retested by an approved veterinarian and released from quarantine by the State Department of Agriculture.

3. Out-of-state cattle consigned to public stockyards within the state where federal or state inspection is maintained may enter without test.

All inter-state health certificates must be approved and endorsed by the proper livestock sanitary officials of the state of origin, one copy of the certificate to be mailed at time of shipment, to the State Department of Agriculture, Division of Livestock Sanitation, Madison, Wisconsin.

Intra-State Bang Test Regulations:

All cattle, except steers, sold privately or at auction where ownership is transferred or where the animal is moved from one herd to another, must comply with one of the following Bang test requirements:

1. Cattle shall originate in a Bang's **disease free accredited** herd in good standing, which has been last tested within twelve months from the date of sale or transfer, or

2. Cattle shall originate in a herd in which there was no evidence of Bang's disease since the last test, and all members of which have passed a completely negative test within six months from the date of sale or transfer, or

3. Cattle shall pass a completely negative official Bang test within thirty days of the date of sale or transfer, or

4. Cattle passing a negative Bang test within thirty (30) days under the procedure where the blood samples were secured by the holder of a blood-sampling permit, and tested by a duly qualified and licensed veterinarian, may be moved to a concentration point where the official Bang test shall be made.

No cattle except steers, shall be bought, sold, or transferred into other herds unless accompanied by an official Bang test record. Such record shall be issued on state Bang Form No. 1, and can be issued by a duly

licensed and qualified veterinarian, or may be secured from the State Department of Agriculture. Only the animals involved in the sale or transfer need be listed on Bang Form No. 1, along with the reactions of the Bang test, but if a herd or group test was made at the time the listed animals were tested, the veterinarian shall also fill out the portion of the report listing the total number of animals tested, number of negative animals, number reacted and number suspicious; also whether or not the test constituted a complete herd test. Any exposure to Bang's disease infection within 90 days of the test must be recorded on record.

County Bang Area Test Regulation:

No cattle shall be transported, driven, trailed, or otherwise moved into a Bang-area-test county, or moved from one herd to another within such county, unless they comply with one of the following provisions:

1. Pass a completely negative official Bang test within 30 days prior to the date they are moved into the county, or into another herd within the county. Such animals must be kept segregated and apart from other cattle until they have passed a negative retest not less than 15 days nor more than 30 days from date of purchase or movement before being added to the herd.

2. Originate from a herd, all members of which have passed a completely negative Bang test within six months.

3. Originate from a Bang's disease free accredited herd.

All cattle entering a Bang-area-test county or moving from one herd to another within such county must be accompanied with a copy of the qualifying Bang test record. Such record shall be made out on state Bang Form No. 1, and can be issued by a duly licensed and approved veterinarian, or may be secured from the State Department of Agriculture. Only the animals involved in the sale or transfer need be listed on Bang Form No. 1, along with the reactions of the Bang test, but if a herd, or group test was made at the time the listed animals were tested, the veterinarian shall also fill out the portion of the report listing the total number of animals tested, number of negative animals, number reacted and number suspicious, also whether or not the test constituted a complete herd test. Any exposure to Bang's disease infection within 90 days of date of test must be recorded on record.

Reference: Wisconsin State Department of Agriculture

An important factor of disease elimination in addition to testing and the slaughtering of Bang's reactors, is a proper system of herd management aimed at preventing reinfection in the herd. Additions to herds and the proper handling of additions are two of the biggest factors that require attention. In order that you may protect yourself on purchases of additions to your herd and be assured of indemnity payments in case reactors are found, later on, you should be guided by the following: On every cow you purchase, insist on the seller furnishing you a certificate before ownership passes to you. The card furnished should give the name of the herd in which the animal originated and the history of the complete herd test, that is, the number passed, the number that reacted and the number tested. Insist on this history being on the record; do not buy from a herd showing infection.

You can add to your herd -

1. Cattle from certified herds

2. Cattle from herds tested free, with no history of infection within 6 months

3. If you buy individual animals tested within 30 days, obtain the test card. In case the test card does not give a clean herd history, these animals must be kept separate from the rest of the herd until they will have passed a clean test in not less than 15 days nor more than 30 days before being added to the rest of the herd, otherwise no indemnity will be paid.

If you have a test made on such animals, be sure that the veterinarian furnishes you a copy. This copy together with the card obtained at the time of purchase, will determine if you are entitled to indemnity or not.

We earnestly request you to cooperate in regard to additions to your herd, more for your own sake than ours, as additions to your herd may be costly to you and may be handled in such a manner as to preclude the possibility of our paying indemnity if they react.

We also wish to impress you with the care necessary in placing your stock out in a community pasture, or permitting stock to pasture with your herd. It is advisable to treat all pasture cattle as additions to the herd, they should be tested at the time they are brought in and before being added to your herd at home. This will prove a valuable insurance to your home herd if clean.

Cows at the time of calving or aborting are the most likely spreaders of the disease and under the usual system of herd management pregnant animals are intermingled with the remainder of the herd throughout the year. Pregnant cows prior to calving should be maintained in maternity stalls or barns in isolation from the remainder of the herd until a negative blood test result is obtained two to four weeks following the dates of calving or aborting.

Abortions occurring in the stable or in the pasture should be considered due to Bang's disease until otherwise determined and should be handled ac-

cordingly. The place where the abortion occurred should be thoroughly disinfected. The fetus and enveloping membranes should be burned or buried so that they will not be accessible to livestock or birds.

Animals in herds may also become infected through other sources as visitors, feed bags, trucks used to transport cattle, adjoining pastures or dogs carrying afterbirths or other contaminated materials into pastures or barns, and a number of other ways.

All reactors should be considered dangerous and should be sent to market at the earliest opportunity. Calves receiving milk from infected cows may also be spreaders and should be separated from the negative herd and should not soil feed and bedding used in the herd.

Manure pile should be located and drainage should be constructed so that cows in exercise yards or pasture cannot come in contact with them. Remember a thorough cleaning and disinfection of premises pays big dividends in disease control.

Animals showing suspicious results should be considered dangerous also, and should be repeatedly retested until their true status has been determined.

IMPORTANT: Biologics containing bacillus abortus (Bang's disease organisms) should not be used without obtaining a permit from the State Department of Agriculture.

Reference: U.S.D.A., Bureau of Animal Industry, and
Wis. Dept. of Agri., Div. of Livestock Sanitation

With the passage of new legislation relative to calfhood vaccination, Wisconsin farmers now have a choice of seven procedures for controlling Bang's disease in their herds. Bill 616-A, authorizing official and unofficial methods of vaccinating calves, was passed by the legislature early in June, signed by the governor June 22, published the following day, and is now documented as Chap. 362, Laws of 1943.

We are calling to your attention the various programs for controlling Bang's disease because we know that you receive many inquiries on this subject. The State Department of Agriculture is publicizing these programs in the press and by radio, and is now preparing a pamphlet to explain them in detail.

Arrangements are now being formulated to vaccinate calves in the counties in which Bangs area testing is being performed. Such vaccination will take place at the same time that the regular area testing is being done without cost whenever the farmer agrees to cooperate. By so doing, there will be definite areas in which the work will be done on a comparatively large scale. To maintain an accredited herd, the owner must continue with periodic vaccinations just as is being done in periodic testing for Bang's disease.

1. Official vaccination of calves between the ages of four and eight months by a qualified veterinarian on permit issued by the State Department of Agriculture, and with permanent records kept of vaccinates. Vaccination permits will be issued without requiring that the herd be tested.

2. Unofficial vaccination by the herd owner on calves in his own herd, without a permit and with no official records kept.

3. Voluntary testing of herds under permit, by an approved veterinarian, with indemnities paid by the state and federal governments on reactors sent to slaughter.

4. Area testing in which all of the cattle in a county are Bang's tested if 75% or more of the resident cattle owners sign a petition for such a test, and with indemnities paid on reactors.

5. Official calfhood vaccination in combination with the test and slaughter program. Under this plan, vaccinates are permitted to associate with the remainder of the herd until they reach breeding age. Indemnit will be paid if they react after a period of 18 months following vaccination.

6. Vaccination, under permit, by an approved veterinarian, of calves in clean herds. Under this procedure vaccinates are allowed to associate with the herd but the herd is not classed as accredited during the time the vaccinates are reacting.

7. Vaccination, under permit, by an approved veterinarian, of calves in a Bang's-free accredited herd. To retain his certificate of Accreditation, the herd owner is required to keep the vaccinates apart from the herd, in separate stalls, yards and pastures until they become negative.

Reference: State Dept. of Agr. -- Milton H. Button, Director

SECTION VII - OTHER LIVESTOCK

(Continued)

PAGE

HORSES (Cont.)

STEERS

FEEDING OF HOGS

Wisconsin farmers produce about 2,000,000 hogs for market each season. Sold as pork, these hogs are in reality marketing corn, grain, skimmilk and other farm feeds at higher net profit than would be returned if these feeds were sold for cash.

To bring the highest net returns, good rations and good feeding practices must be followed. Corn and grain, low in protein and vitamins, must be supplemented with feeds that provide these growth factors. Minerals, pasture, skimmilk and whey and feeding mixtures all enter into the question of efficient and economical swine production. Only good feeds, good feeding and sound planning of the pork program will yield regular annual profit.

A. Pasture Saves on Feed

1. One acre of good pasture will save 1000 pounds of corn and 500 pounds of protein supplement.

2. Pasture induces pigs to remain in the sunshine to be supplied with vitamin D.

3. It gives opportunity to use sanitary ground that is free from parasites.

4. It increases growth of pigs to permit earlier marketing at higher prices.

5. Alfalfa has proven to be the most valuable of all pastures.

6. Alfalfa is high in protein, mineral matter and vitamins and is palatable and nutritious.

7. Clover, rape and combinations with oats and peas are very satisfactory.

8. Only one-half as much protein supplement is required as when on dry lot.

B. Prevent Pig Losses by Simple Precautions

1. Clean and scrub pens, and scald with boiling water and lye before farrowing time.

2. Scrub the sows with warm water and soap before farrowing.

3. For spring farrowing use an electric or hot water brooder to prevent chilling of newborn litters.

4. Build in guard rails or fenders on at least two sides of the pen with 2" x 4" or 2" x 6" placed 8 to 10 inches above the floor and away from the wall.

5. Arrange to have the sows in the pens two to three days before far-

rowing -- early enough so that they can get acquainted with their new quarters.

6. Place a small amount of bedding in the pens at farrowing time in order to prevent smothering by sows.

7. Careful hog men like to be on hand when the sows farrow. It may be necessary to take pigs away from the sow if she is restless. A box or half barrel with a burlap sack for cover will keep the pigs comfortable until they are returned to the sow.

8. Nervous and restless sows may frequently quiet down after the sharp teeth of the new born pigs are clipped. Do not clip the teeth unless you use a sharp clipper. Crushing the teeth may cause infection.

9. Keep sows and pigs in pens, away from worm and disease infested hog lots until pasture season.

10. Put some clay or loam soil in farrowing pens to supply copper and iron to prevent thumps. Such soil should be from a field which has had no hogs on it for several years.

C. Use Dairy By-Products

Efficient and economical use of by-products of dairying on Wisconsin farms should be planned. Hogs make excellent use of skimmilk, buttermilk and whey. Four to six pounds skimmilk or buttermilk per pig, or 8 to 10 pounds whey per day are needed.

D. Creep Feed

Arrange a "creep" or pen for pigs where sows are excluded. Start creep feeding early. Place cracked or ground corn in a trough or feeder, and feed skimmilk, buttermilk or whey in another trough. Oats or barley used in place of corn should be ground medium fine. Slop feeding of pigs during suckling period has no advantage.

E. Raise Fall Litters

1. Sows bred for fall litters may be mated 3 or 4 days after farrowing or after the litters have been weaned. Good feeding after breeding is important in the strength of pigs born.

2. Early farrowed fall pigs develop rapidly during good fall weather, will produce cheaper pork, and will be ready for earlier spring markets.

F. Castrate Early

Male pigs to be sold as market pork should be castrated at 2 to 3 weeks of age. A scalpel or razor blade is convenient for this purpose. Use milk disinfectant -- a commercial disinfectant used according to directions, or kerosene, will be satisfactory.

G. Control Worms

Use oil of chenopodium and castor oil as a worm expellant when pigs are 10 to 12 weeks of age. Mix 1 ounce oil of chenopodium in 15 ounces castor oil. After pigs have been starved 12 to 14 hours, give 2 ounces of the mixture, per pig. Use a blunt nozzle syringe for administering the oils. Keep off feed for 1 to 2 hours after dosing. The use of phenothiazine is now being recommended.

H. Dip for Mange

To control mange, arrange a small tank or barrel with about 2 feet of water in the bottom. Add 10 gallons waste crankcase oil and 2 gallons kerosene to the water. Dip the pigs thoroughly in this mixture. It is not harmful to eyes, mouth or ears. Dip when pigs are 10 to 12 weeks of age. Dip or spray the sows at the same time. Lime sulfur may be used to replace oil and kerosene. Use it in correct proportions for home prepared or commercial materials.

I. Rations in Dry Lot

1. Cereal grains, protein feeds of animal origin, plus legume hay, will comprise rations which produce rapid and cheap gains. However, it is now more necessary than formerly to substitute animal protein concentrates with oil meals and mill feeds.

2. Self-fed or hand-fed mixture:

	Pounds
Ground corn	89.5
Linseed meal or soybean oil meal	5.0
Ground alfalfa hay	5.0
Salt	0.5
	100.0

Hand-fed:

Skimmilk or buttermilk 4 to 6 pounds per head daily

3. Self-fed free choice:

Shelled or ground corn
Supplement mixtures (Tankage 20%, linseed meal or soybean oil meal 50%, ground alfalfa hay 25%, ground limestone 3%, salt 2%.)
Free access to salt in box or feeder

4. Hand-fed:

Ear corn
Supplement mixture -- About 3/4 pound per head daily

5. Hand-fed:

Ear corn
Skimmilk or buttermilk -- 6 pounds per head daily
Free access to salt in box or feeder.

6. With tankage, buttermilk, skimmilk or whey, no minerals other than salt are needed. If proteins are all of vegetable origin, free access should be given to a mineral mixture of 40 pounds ground limestone, 40 pounds steamed bone meal, and 20 pounds salt.

J. Rations on Pasture

1. Pasture crops are rich in protein. Little more than one-half as much protein supplement will be needed on pasture. Some animal protein in the supplement will produce more rapid gains. However, supplements with only plant proteins will produce pork economically. Salt should be supplied, free choice. On good alfalfa, red clover, or rape pastures the following rations are recommended.

2. Self-fed free choice:

Shelled or ground corn
Tankage or a mixture of 1/3 tankage and 2/3 linseed meal or soybean oil meal
Salt

3. Self-fed or hand-fed:

Shelled or ground corn or ground barley
Salt

Hand-fed:

Skimmilk -- 3 to 4 pounds per head daily

4. Self-fed or hand-fed mixture:

Ground corn	82.5
Standard wheat middlings	8.0
Linseed meal or soybean oil meal . .	8.0
Ground limestone	1.0
Salt	0.5
	100.0

5. For at least a month after weaning, pigs on the above ration should be fed if possible 2 to 3 pounds skimmilk or buttermilk, or 6 pounds whey. Or 6 pounds tankage should replace that many pounds corn in the 100-pound mixture. Wheat may be substituted for any or all of the corn in rations above.

6. If pastures become dry and useless in late summer, regular dry lot rations should be fed.

K. Care and Feed for the Brood Sow

1. Gilts and sows should be well fed and thrifty at the time of breeding -- larger and better litters.

2. Brood sows must have enough of the right kind of feeds.

3. Brood sows need exercise if they are to farrow strong pigs.

4. Heavy milking sows give the pigs the desired start.

5. Feed thin slop containing ground oats and bran or oil meal for 12 or 24 hours after farrowing. Gradually increase the feed until a full feed may be reached in a week or ten days.

6. Full feed means about 3 to 4 pounds per 100 pounds live weight.

7. Gradually increase the fattening feeds (corn and barley) and reduce the growing feeds (oats).

8. Brood sow rations

Ground wheat, corn, or barley	1090 lbs.
Ground oats or rye	300 "
Wheat middlings	100 "
Soybean oil meal or linseed oil meal . . .	100 "
Tankage	100 "
Ground alfalfa hay	300 "
Iodized salt	10 "
	2000 "

(Note: The ground alfalfa hay may be removed from the ration when sows are on pasture. Only good quality hay, fine-stemmed, leafy, if possible pea-green, should be used in hog rations. The above mixture serves both bred and suckling sows except that, when nursing a litter, a sow needs larger amounts of the feed.)

L. Methods of Feeding

1. Full feeding vs. limited feeding: Full fed pigs make faster gains and are ready for market in less time with better prices and less labor.

2. Self-feeding vs. hand-feeding: Pigs are well adapted to self-feeding, do not overeat, balance their own ration, and gain faster than when irregularly fed.

3. Dry vs. slop feeding: Slop barrel is not necessary or economical. Dry feeds are just as economical, more thoroughly chewed and involve less labor. Must have access to good water.

M. Value of Feeds and Minerals

1. Corn is the chief cereal grain used as a pig feed. Corn alone is not satisfactory.

2. As a rule, it does not pay to grind corn.

3. Ground barley is worth 93% as much per unit of weight as shelled corn.

4. Oats are worth more for other livestock than for fattening hogs.

5. Rye is not as palatable but can be used to a good advantage as a pig feed.

6. Wheat when ground is worth at least as much as corn for pig feed.

7. Salt should always be supplied to hogs.

8. Ground limestone and a little bone meal are about the only other minerals needed when rations are balanced with plant proteins.

N. Whey as a Hog Feed

1. Whey proteins are good for supplementing grain proteins.

2. Whey contains milk sugar which aids in digestion.

3. It is also very rich in calcium and phosphorus.

4. With the exception of vitamin A, whey contains in general the same vitamins contained in milk.

5. Whey has a great nutritional value because of the necessary amino acids it contains.

References: Wis. Bull. 454 - "Feeding & Management of Market Hogs" - Dec., 1941
Wis. Sp. Cir. - "More Pork in 1943" - Rev. Mar., 1943
Wis. Sten. Cir. 233 - "Whey as a Livestock Feed" - Rev. May, 1943
Minn. Ext. Fold. 90 - "Care and Feeding of Brood Sows" - June, 1941

DISEASES OF HOGS

Many swine breeders consider swine erysipelas a new disease. This is not true. It was recognized many years ago. It is, however, new to many breeders. We know of no disease where carriers occur with more frequency. Due to the movement of breeding stock and feeders this disease is becoming wide-spread in Wisconsin

Swine flu, another disease that has become prevalent in recent years, is spread in the same manner.

Hog cholera. While traffic in hogs frequently spreads this disease, there are many other ways in which it is spread.

Differing from cattle and horses, hogs do not eat great quantities of roughage which in several respects are protective foods. A successful hog grower must, therefore, know how good rations may be provided.

Vitamin deficiencies. These may take the form of stiffness, inability to walk properly, rough coat, and unthriftiness.

Vitamin deficiencies are prevented by raising pigs on good pasture, preferably on annually rotated pasture, so as to reduce as much as possible the danger from intestinal parasites. If pigs are raised in confinement, it is desirable or necessary that the home-grown grains and any additional oil meal or millstuff be supplemented with at least some animal protein like tankage, fishmeal, or skimmilk, also with liberal amounts of leafy, pea-green hay. The hay may be fed in a suitable rack or may be ground fine and mixed in amounts of 5 to 15% or more of the ration.

Mineral deficiencies. Animal protein and hay in the ration usually supply all the necessary minerals along with the vitamins, although it is advisable to mix 1/2 pound salt in every 100 pounds of feed.

If the ration is balanced entirely with soybean oil meal or other oil meal, and with middlings or other millstuffs, to prevent rickets, it is necessary to mix with the ration about 3/4% ground limestone, or 3/4% of a mixture of ground limestone and steamed bone meal. It is in most cases satisfactory to let pigs have free access to the separate minerals in suitable mineral boxes or self-feeders. To prevent hairless pigs, sows should be fed iodine by way of iodized salt.

Newborn pigs that are with their dams and are kept indoors for some weeks should be protected against anemia by swabbing the udders of a sow daily with a solution of copper and iron. Or a few shovelfuls of uncontaminated soil thrown into a corner of the pen for the little pigs to root over will supply them with enough iron and copper to prevent anemia which frequently takes the form of "thumps".

MORE SHEEP FOR MEAT AND WOOL

Meat for food, wool for clothing and equipment, and pelts for flying suits will be needed for America and the United Nations. Sheep and lambs are the sources of these products. Sheep will provide fleeces for woolen materials, and lambs will be useful in meat and pelt production. Wisconsin flocks will contribute their share to the national output for the duration.

A. Feed Ewes Properly

Good production comes from flocks well fed and managed. For winter feeding of the breeding flock, alfalfa, clover, or other legume hay should be the roughage. Silage, free from mold, is beneficial. For the two months before lambing, a grain mixture, equal parts of corn, oats and bran, fed one-half to one pound per head per day, is excellent. Shelter that is not too warm is important. Daily exercise will prevent excessive fat and improve vigor of bred ewes.

B. Save the Lamb Crop

Be present when lambs are being born. Attention then will prevent unnecessary losses. Have lambing pens for individual ewes. In cold weather, have lambs born in warm quarters. Feed lambing ewes a grain mixture, with equal parts bran and home-grown grains. Have plenty of fresh water available.

C. Start Lambs Early

Creep feed a grain mixture of equal parts cracked corn, whole oats, and bran when lambs are ten days to two weeks of age. Early gains are cheap and rapid gains hasten marketing. Creeps constructed by placing slats vertical, twelve inches apart, are satisfactory. Troughs for creep feeding should be six inches from the floor.

D. Dock Lambs When 1-2 Weeks Old

Dock all lambs when one to two weeks of age. Castrate all male lambs to be sold for market purposes. This should be done approximately one week after docking. Use a milk disinfectant and use satisfactory equipment for both operations. The docking may be done with pruning shears or with some instrument made for the purpose. While the hot-iron method of docking prevents bleeding, it does cause injury that is slow to heal. Kerosene or distillate make satisfactory disinfectants and fly repellants.

E. Drench Before Pasture Season

Breeding flocks should be drenched with copper sulphate-nicotine sulphate solution before being turned on pasture. Use commercial solution according to directions, or mix 1¼ ounces nicotine sulphate in one gallon water and give four ounce dose to mature sheep. Treat the breeding flock with penothiazine twice during winter months to control or eliminate nodular worms.

F. Shear Properly

Prevent wool losses through proper shearing. Use standard shearing plan to conserve wool. Write for shearing directions to the College of Agriculture, Madison, or to manufacturers of shearing equipment. Avoid second cuts to increase wool value. Remove dirty and soiled locks before fleeces are tied. Shear only when wool is dry. Damp and dirty fleeces will cause loss during storage. Use only paper twine for wool tying. Keep wool stored in dry place. Use paper or burlap bags for shipment. Sell wool on grades.

G. Dip and Drench for Parasite Control

Dip all sheep and lambs during warm weather to control ticks and lice. One dipping per year will suffice. Use dependable dipping material. Portable dipping vats, when available, are very satisfactory. Community vats, permanently constructed, save time, labor and money. Give at least one summer drench for control of stomach and tape worms to sheep and lambs. Copper sulfate-nicotine sulfate solution at 4 ounces per sheep and 2 ounces per lamb, will be useful. Starve sheep and lambs for 10 to 14 hours before drenching. Drench breeding flock again just before breeding time.

H. Rotate Pastures

Rotation of pastures will reduce parasite losses and increase feed production. Where possible, rotate once per month. Clover, alfalfa, blue grass, and emergency annual crops -- peas, oats, rape, or rape alone -- are excellent all-season feeds. Use care in damp, hot weather, to prevent bloat. Grain feeding in hot weather, when pastures are dry, will be profitable. Self-feed the lambs a mixture of corn and oats, half and half.

I. Sell Lambs When Fat

Lambs should reach market condition at 5 to 6 months of age. Good lambs must be fat. Weights of top lambs will be 80 to 100 lbs. Do not wean lambs unless feeding conditions are bad. Lambs permitted to nurse until sold will make better gains.

J. Produce Shearling Pelts

If lambs and market ewes are shorn two months before selling time, pelts will grade as shearlings, and may be used for air corps purposes. Pelts for such purpose must carry only white wool, and should grade three-eighths blood or finer. Western lambs brought to Wisconsin for feeding purposes are excellent for shearlings.

K. Use Good Purebred Rams

Good rams, thick and heavy, with good fleeces, sire good lambs. Rams purchased from reliable breeders of purebred breeds will be dependable and economical.

L. Keep Ewe Lambs

Keep from ten to twenty per cent of each lamb crop for replacement. Strong, vigorous ewes produce strong, vigorous lambs. Improvement in production of lambs and fleeces is more rapid when replacements are rapid.

M. Good Management Necessary

1. Good management means a high percentage of vigorous twin lambs and high yield of good grade wool.

2. Good feeding a few weeks before breeding results in more twin lambs, more vigor and more uniformity in age of lambs.

3. Sheep are well protected from cold but not against wet weather. Hence, they need dry shelter which provides good ventilation.

References: Wis. Sp. Cir. - "More Sheep for Meat & Wool" - Jan., 1943
Wis. Cir. 270 - "Better Sheet Management" - Rev. Aug., 1941

SOME COMMON AILMENTS OF SHEEP

Ailment	Symptoms	Treatment
Sore eyes	Eyelids turn in	Trim excess skin from eyelids with small shears. This will shorten lid and prevent recurrence of inverted lids. Silver nitrate ointment or 10% argyrol solution.
Indigestion	Diarrhea or constipation	2-4 tablespoons castor oil according to age.
Maggots	Twist and squirm	Remove wool on area, apply strong sheep dip or pine oil -- gasoline if nothing else. Ether or chloroform are best, but expensive.
Lice, ticks, mange	Rubbing and unthrifty	Dip once a year in Coopers solution
Stomach worms	Dullness and unthrifty, paleness of skin	Dissolve $\frac{1}{4}$ lb. copper sulphate in pint of boiling water, add cold water to make 3 gallons -- all in porcelain or glass. Give with syringe or rubber tube and funnel as follows: 1 oz. - Under 50 lb. lambs 2 oz. - Over 50 lb. lambs 2-3 oz. - Yearlings 3-4 oz. - Mature -- Alternate Treatment -- Phenothiazine may be mixed with salt -- 1 part PTZ to 9 parts salt -- and fed free choice to farm flocks. Place in salt box or container and allow free access all year.

WORK HORSE PURCHASING RECOMMENDATIONS

The purchase of a work horse or team usually represents a considerable outlay of money. Many farmers have lost money and valuable time in the field because of purchased horses that when put to heavy work died or proved unsatisfactory because of age or unsoundnesses. A suitable horse should enable a farmer to do his work satisfactorily and last long enough to give proper return in proportion to the original cost.

Farmers who have difficulty in detecting unsoundnesses in horses or in determining age of horses, etc., should have a skilled horseman assist them when buying work horses. Deal only with persons known to be honest and dependable and do not rely too much on statements of horse sellers or dealers.

A purchased horse or team may be a wise investment or a money losing proposition, depending considerably upon how wise a selection is made and how much is paid.

The following are some important points to be observed when purchasing work horses:

A. Select Home Raised Horses Where Possible

They are more likely to be acclimated and free from contagious diseases and bad habits. They should be available at lower prices than horses that are shipped in.

B. Servicably Sound

1. Gentle and good disposition

   a. Well broken to harness and all types of work
   b. Easily handled and trusted.

2. Condition

   a. Good flesh indicates health and thrifty feeder

3. Shape - Size - Conformation

   a. Compact, short-legged horses with short backs, deep middles, well placed legs, and good feet make the most efficient animals.

   b. Weight range will vary with local needs and uses (usually over 1400 pounds).

4. Good vision in both eyes

   a. Eyes should be large, clear and sound

5. Age

   a. Avoid old animals (See pages 14, 15 and 16 for aids in learning to determine age of horses.)

C. Unsoundness and Vices

1. Be able to detect heaves, poor wind, unsound joints, lameness and other common unsoundnesses such as sidebone, ringbone, thrush, founder, fistula, bad shoulders, also symptoms of disease such as distemper, etc.

2. Watch for evidence of vices such as kicking or striking in harness or in the stall, biting, cribbing, mean or nervous disposition.

D. Hitch and Work Test

1. Watch carefully while the horse is groomed, harnessed and hitched.

2. Hitch to heavy implement such as a spreader, loaded wagon or wagon with rear wheels blocked to test horse for pulling and balkiness.

3. Drive horse rapidly for a distance of 40 rods or more to test for heaves and wind.

E. Guarantee

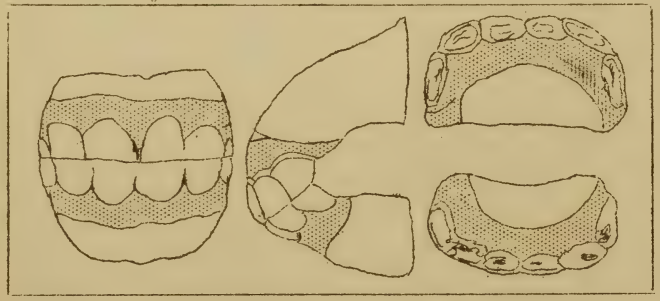
1. Obtain a bill of sale.

2. Have a definite understanding as to guarantee seller gives on horse being purchased. A guarantee is no better than the man who makes it. Do such a good job of buying that under ordinary circumstances you will not need to depend upon a guarantee that may or may not be dependable.

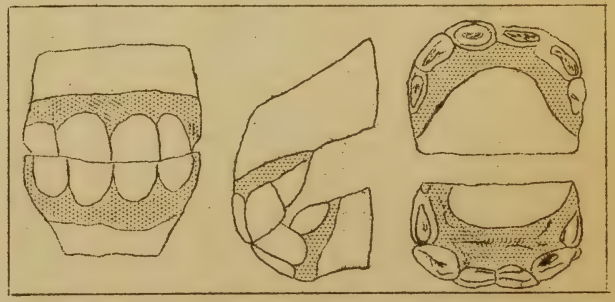
(See pages 14, 15 and 16 for aids in determining the age of horses.)

DETERMINING THE AGE OF HORSES BY THE TEETH

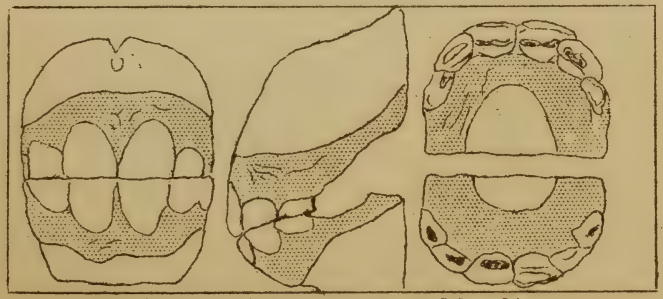
The age of the horse is easily determined through the fifth year by examining the incisor teeth. (There are 3 pairs of incisor teeth in both jaws. The colt has milk teeth up to 2 years of age. At 3 years, the middle pair of milk teeth on both jaws are shed and replaced by permanent incisors. (Permanent incisors are broader, heavier teeth and have a rather rough or corrugated surface.) At 4 years, the second pair appears and at 5 years, the last pair. After 5 years, age is not so easily determined and reliance must be placed upon changes in appearance of the wearing surface and shape of the teeth and the shape of the jaw. The following charts should be of help in learning to determine age of horses by their teeth.



Teeth of the two-year-old colt
The corner teeth are in full wear.



Teeth of the yearling colt
The milk teeth are all present, although the corner teeth are not yet in full wear.



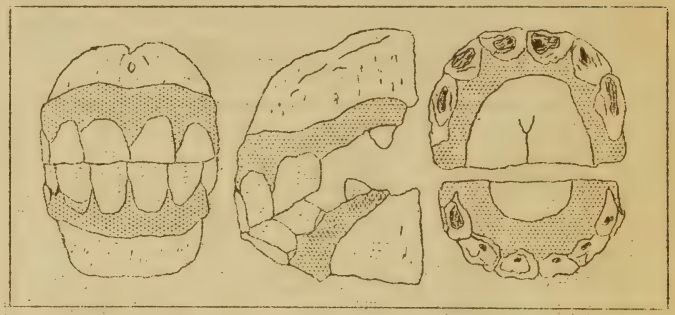
Teeth of the three-year-old colt.
The permanent central incisors have emerged and are just coming into full wear.

Teeth of the four-year-old horse.
Both the permanent central and intermediate incisors are in full wear.

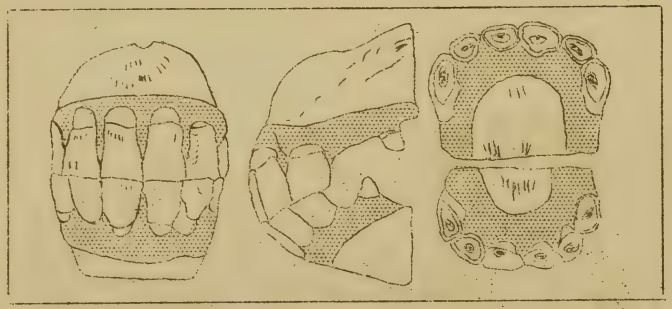
Teeth of the five-year-old horse
Since all of the permanent incisors are in wear, the horse is said to have a "full mouth." The canine teeth are usually present in the stallion and gelding but are rarely seen in the mare.

Teeth of the six-year-old horse
The cups or indentations of the lower central incisors are almost completely obliterated.

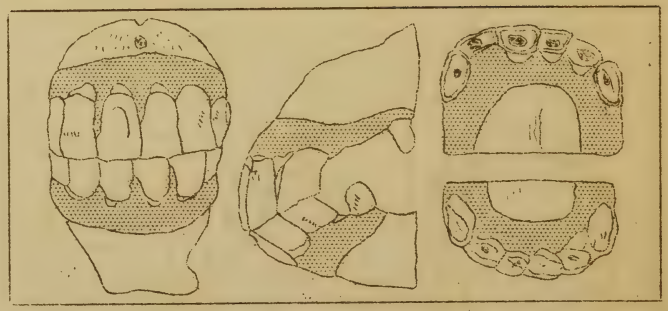
Teeth of the seven-year-old horse
The cups of the lower centrals are usually completely obliterated, and are very shallow in the laterals.



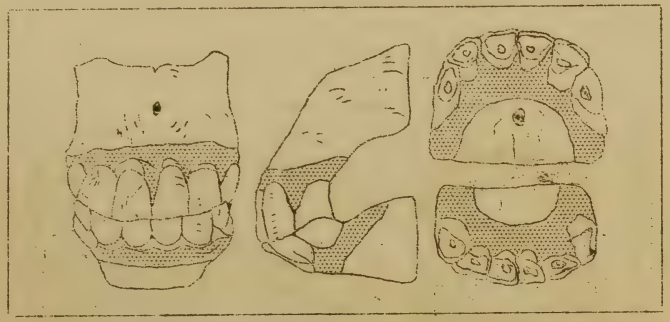
Teeth of the eight-year-old horse
The cups have completely disappeared from centrals, and laterals, and are partly gone from the corners. A small swallowtail, or hook is often apparent on the upper corner at seven and eight years.



Teeth of the nine-year-old horse
The lower incisors are "smooth". The cups are beginning to disappear from the upper incisors, particularly from the upper central incisors.



Teeth of the twelve-year-old horse
The twelve-year-old has a "smooth mouth" because the cups are entirely obliterated from both the upper and lower incisors.



Teeth of the fifteen-year-old horse
The teeth appear slanting when viewed from the side. When the mouth is opened, the wearing surfaces of the incisors appear more triangular than the teeth of the younger horse.

Teeth of the twenty-one-year-old horse
When viewed from the side, the teeth appear very slanting and oblique.

TABLE INDICATING RELATION OF AGE TO THE VALUE OF WORK HORSES

Age Years	Estimated Life Expectancy - Years	% Maximum Value	*$ Value at Indicated Age If Maximum Value is $200
0	12.4	---	---
1	11.4	45	90
2	10.5	65	130
3	9.6	85	170
4	8.8	95	190
5	8.1	100	200
6	7.4	100	200
7	6.8	95	190
8	6.3	90	180
9	5.8	85	170
10	5.4	80	160
12	4.6	60	120
14	4.0	40	80
16	3.5	35	70
18	3.0	25	50

* Assuming value for fox meat or hide

HORSE FEEDING AND CARE

I. Horse Rations

A. Work Horse - Average Work

Feed approximately one pound of grain and one pound of hay daily for every hundred pounds live weight of the horse. On this basis, a 1500-pound horse at work will need from fifteen to eighteen pounds of oats and about the same quantity of hay a day, depending on the type of horse and the work. Oats may be given in three equal feeds at morning, noon and night. The hay should be given at the rate of about two-thirds at night and one-third in the morning.

Corn may be fed to some extent to work horses where it is available. Good results follow the use of corn as one-third by weight of the grain ration for work horses.

In some sections barley is fed to horses, but it is not considered a safe feed for work horses since there have been many cases of colic thought to be due to barley. If used, barley should be ground and thoroughly mixed with crushed oats at the rate of one-third barley and two-thirds oats.

B. Colt Feeding

The foal should nurse (on the average of) six months. At about two months of age the foal will start to eat a little grain and should be supplied a mixture of oats and bran, if possible. From six months of age and up to one year the foal may be fed a grain ration of four-fifths oats and one-fifth bran by weight and all of the good quality legume hay it will eat. During the first winter the colt will probably consume about one and a half pounds of grain mixture for each one hundred pounds weight and six to eight pounds of good quality hay per day. After one year of age the colt can be raised on more roughage and less grain. If given good pasture of a liberal supply of good roughage the yearling colt will grow well without grain except during the winter months. During the second and third winters for about four months, it is advisable to feed grain twice a day in addition to good quality hay. From eight to twelve pounds of grain mixture a day is ordinarily sufficient.

II. Care of Work Horse

To the extent possible farm work horses should be fed grain and stabled in proportion to the amount of work they are required to do. Horses which are regularly not needed for daily work should be turned out to pasture or yarded and fed good quality roughage. Since most farm horses work only about 25 per cent of the time, one can economize greatly on their keep by cutting the grain allowance during idle periods. By watching the condition of horses and using judgment in feeding and housing them, there should be a

definite saving in feed and labor over the plan followed by some who tend to stable and grain feed their horses too much when not at work.

Many horses die every winter from what is known as impaction. Impaction is overloading the large bowel with feed of improper character. This one thing probably causes the death of more horses every year in Wisconsin than all other causes combined. The idea that almost anything is good enough for a horse that is not working is all to prevalent. While it is true that idle horses do not require as much, the quality of feed should always be maintained. And don't forget that colics are far less likely to occur in horses that exercise regularly.

III. Preparation for Spring Work

One should not economize in wintering horses to the extent that they are weak and not in condition for hard work in the spring. Horses that have been wintered largely on roughage should be given grain at least four weeks before field work begins. Animals not in strong condition are unable to stand heavy work and tire out so that their usefulness is greatly reduced at a time when they should be most efficient. A wise farmer will prepare his horses for the work they are expected to do.

IV. Care of Teeth Important

The old saying that "a horse is as good as his mouth" is many times true. It is a fact that far too many horses are unthrifty because there is something wrong with their teeth. The teeth grow out as they wear down. They never wear even; often sharp points appear that continually irritate either the cheek or the tongue.

Many old horses are being worked at the present time; and a little dental work may transform a horse thought to be nearly useless into a serviceable animal.

Feeding old horses - When the teeth are worn so that proper grinding is impossible, many times the horse may be kept in good workable condition by a good ground feed mixture. Such horses will many times eat grain all right. Owners of such old horses should either give them ground feed or put them out of the way.

SUGGESTIONS ON FEED AND CARE OF WORK HORSES

1. Feed regularly, adhering as nearly as possible to the same program each day.

2. Do not feed grain when the horse is tired and hot. Have some fresh hay in his manger but give him a half hour to cool off before graining him.

3. Water often, at least four or five times daily, but do not let him drink more than a pailful (10 or 12 qts.) when he first comes in from work if he is tired and very warm.

4. Feed less grain when the horse is not working, reducing the quantity one-half on Sunday and rainy days or whenever he is standing in the barn.

5. Always feed hay first, giving the heaviest feed at night. When pasture is available, it is well to turn him out at night after the weather is warm.

6. Avoid sudden changes in the kind of feed, such as old oats to new, old hay to new, etc.

7. Bulky, dusty, or moldy food should not be used. Such material causes colic, heaves, etc.

8. If the horse seems unthrifty and does not eat well, have a competent person examine his teeth. They may need floating.

9. In general, feed daily 1-1/10 pounds of grain and 1-1/5 pounds of hay for each 100 pounds the horse weighs when doing moderate work. At this rate a 1400-pound horse should have 15 pounds of grain and 17 pounds of hay a day. The exact quantity will depend upon the individuality of the horse and the work he is doing.

Suggested Rations

Morning	Noon	Night
4 quarts oats	5 quarts oats	4 quarts oats
4 ears corn	*5 pounds mixed hay	4 ears corn
*5 pounds mixed hay		*7 pounds mixed hay

10. Horses should have salt where they can lick it at all times.

11. Collars and hames should fit well and be kept clean to avoid sore shoulders.

12. To fit a collar properly, have it tight on the sides so as to admit the finger tips only, and long enough to admit the hand at the bottom.

* Mixed hay - Clover or alfalfa mixed with timothy. If alfalfa alone is used, corn should be increased and oats decreased.

If the collar seems a little too large, a deer hair sweat pad should be used.

13. Keep the collar clean by rubbing it off with the hand or washing with a damp sponge when it is first taken off the horse. (Preserve its life by oiling it twice a year and always holding it together at the top when carrying it.)

14. To prevent sore shoulders, frequently lift the collar when the horse is working and wipe the shoulders off with the palm of the hand. Raise the collar slightly and allow air to get in. When the collar is removed, wash the shoulders with cold water using a sponge or cloth. If they gall or become sore, use a wash of white lotion made as follows: One ounce of sugar of lead, one ounce of sulphate zinc, dissolve in quart of soft water.

15. Groom the horse after the day's work, or in hot weather wash him off with a sponge, using water which has been warmed in the sun. Do not throw cold water on him.

16. As work decreases, use of pasture may be increased thereby contributing to the health of the horse and reducing the cost of keeping him. If he is to be worked at intervals, grain should be fed when he is working.

17. In the winter time when there is little work to do, roughages such as oat straw, corn stalks, etc. may be used. Some alfalfa hay, 6 to 10 lbs. daily in addition will keep him in good condition. Very little grain will be needed unless he has work.

18. Exercise is important at all times of the year. If there is no work and no place to turn him out, 1 pound of bran or 6 pounds of carrots or potatoes daily should be fed.

19. If alfalfa or clover hay are not available, he should have one to two handfuls of oil meal daily when at work.

References: Wis. Cir. 244 - "Horses for the Farm" - April, 1931
Mich. St. College - "Suggestions on Feed and Care of Work Horses"

FATTENING CATTLE

Beef cattle, if properly handled, do make economical use of non-tillable pasture, low-grade grain and roughage which are by-products of grain production. Therefore, there are frequent instances where beef cattle can be raised advantageously. There are also instances where labor and buildings do not lend themselves to profitable dairy production. In such cases, beef cattle contribute greatly to the building and maintenance of soil fertility.

The quantities of feed given in the rations listed below represent the total daily feed per head averaged for the entire feeding period. The feed allowed a steer the last half of the feeding period would be in excess of the average as given, while that for the first half would be somewhat under.

Suggested Rations - Dry Lot - Fattening Cattle

Ration Number	Feed	Pounds of Feed Per Day Per Head for		
		400# Steers	600# Steers	800# Steers
1.	Corn	13	16	18
	Legume Hay	6	7	9
2.	Corn	10	14	15
	Protein Supplement	2	1-1/2	2
	Mixed Hay	5	6	8
3.	Corn	10	12	12
	Protein Supplement	1-3/4	2	2-1/4
	Mixed Hay	3	4	4
	Silage	7	9	14

Feeding period for the above size animals would vary from 5 to 6½ months, and total feed consumed would average about 45 bu. corn, 250-350 lbs. protein supplement, 1/2 to 3/4 ton of hay, and 3/4 to 1 ton silage.

SECTION VIII - POULTRY

HOW TO PRODUCE MORE EGGS

A. To Increase Egg Production

1. Hold over only good hens and pullets. All poor quality hens and pullets should be sold. If additional housing space is needed, remodel a portion of the hay mow or some other farm building. Do not try to house more birds than the house will accommodate.

2. Use lights on both the pullet and hen flocks. Lights may be started as the days become shorter. They may be used either morning or night, or combination of the two or all night. Regularity in their use is necessary.

3. Reduce flock mortality by not bringing in new stock that may carry diseases. Keep visitors away from the poultry flock.

4. Make the flock comfortable by packing the poultry house walls with shavings, dry sawdust, or by installing a heavy wall pack of straw.

5. Fill the house to capacity with good pullets and hens but do not crowd. Allow at least 3 square feet of floor space per bird.

6. Open the windows to admit direct sunshine.

B. Feed Efficiently

1. Keep available at all times in hoppers a laying mash, supplement, or concentrate.

2. Provide at least 24 feet of hopper space for each 100 birds.

3. Supply vitamin D in sufficient quantity to protect the flocks.

4. Feed grains in troughs or hoppers. Heat wet mash in winter.

5. Supply plenty of fresh water at all times. Heat water in winter.

C. Green Feed Important When No Milk Is Fed

If milkless rations are used, then alfalfa hay or other leafy green material should be made available whenever the flock is not on green pasture. It is important to remember that the vitamins are present in the leaves, not in the stems.

SUGGESTED POULTRY RATIONS

A. We are asked to conserve animal protein by not using more than 2% of animal protein in chick starter and broiler mashes and not more than 2.25% in laying mashes and not over 4.50% in breeding mashes that are fed with grain; that is, 2 pounds meat scrap (50%) and 2 pounds dried milk (32%) in 100 pounds chick mash, total 1.64% animal protein.

B. Owing to the scarcity of animal protein feeds, the following mixtures are suggested. These mixtures will not give quite as good results as we have been accustomed to getting from mixtures such as Wis. #2, #44, #45, etc.

	Chick Starters				Growing Mash Pasture
	Pullets		Broilers		2GW
	2X	2XW	42-1	42-4	
GROUND YELLOW CORN	45	45	40	40	40
GROUND OATS OR BARLEY	0	0	0	0	15
WHEAT BRAN	15	15	15	15	15
WHEAT MIDDLINGS	15	15	15	15	15
ALFALFA LEAF MEAL (May be omitted if chicks are given a good, short, tender green grass range.)	5	5	5	5	0
DRIED MILK	2	0	0	2	0
MEAT SCRAP	2	4	4	2	2
SOYBEAN OIL MEAL (Use either expeller or hydraulic soybean meal or a solvent meal that has been toasted. Raw soybeans are not satisfactory for poultry)	12	12	16	18	14
WHEY	0	(to drink)		0	0
OYSTER SHELL OR LIMESTONE GRIT	1.5	1.5	2	1.5	0
FLINT OR GRANITE GRIT (The grit may be hopper fed after the first 4 weeks. Use chick size for small chicks, then change to growing chick size at 8 weeks and hen size at 20 weeks of age.)	1.5	1.5	2	1.5	0
IODIZED STOCK SALT	.5	.5	.5	.5	1
85D OIL OR POWDER	.5	.5	.5	.5	0

1. Add 4 to 8 ounces of manganese sulphate to a ton of ration if the chicks are to be raised in confinement. This helps prevent "slipped tendon" (perosis).

2. Start feeding grain such as whole wheat, or whole wheat and cracked corn at 4 weeks but continue the starter mash until chicks are at least 6 weeks of age or until the chicks are on good pasture at which time they may be changed to growing mash.

C. Wartime Rations for Laying Hens (Mash Mixtures that Conserve Animal Protein)

	5W	Breeding Mash	Laying Mash with Pasture
YELLOW CORN (If good quality yellow corn is not available, it may be left out as long as the flock has good green pasture of plenty of fresh greens if confined.)	100	100	45
GROUND WHEAT	0	0	40
BRAN	100	100	0
MIDDLINGS (Coarse ground or whole wheat may be used instead of the bran and middlings.)	100	100	0
OATS	100	100	0
ALFALFA LEAF MEAL (When the flock is on good pasture the alfalfa leaf meal may be omitted. A rack of good quality alfalfa hay or other green stuff is suggested in addition to the leaf meal in the mash when flocks are confined to the house.	25	50	0
DRIED MILK (Dried milk is scarce so is left out of the rations of flocks kept to produce market eggs. When eggs are for incubation, the addition of some milk is desirable but not essential if hens can get plenty of leafy green material such as good pasture or good, green alfalfa leaves.)	0	25	0
MEAT SCRAP	25	25	4
FISH MEAL	0	0	0
SOYBEAN OIL MEAL	100	50	12
IODIZED SALT	5	5	1
85D FISH OIL OR POWDER	5	5	0

D. Hopper Feed Minerals, Grits and Grains

1. MINERALS - Coarse crushed oyster shell or hi-calcium limestone grit
2. GRIT - Granite, flint, quartzite, or gravel (Hen size).
3. GRAINS - Oats, barley, buckwheat - if available on the farm.
4. Corn and wheat may be fed in hoppers, on the egg mash or in clean, dry litter.
5. Do not use finely ground feeds. Coarsely ground or whole grain is more readily eaten and more quickly digested.

E. Recommended Poultry Rations from Purdue Based Upon Reduction of Animal Protein

Kind of Feed or Ingredients	No. 114 Chick Starter	No. 314 Broiler Ration	Pullet Growing Mash		Laying Mash	
			No.206	No.207	No.409	No.410
Ground Yellow Corn	285	570	570	485	405	335
Ground wheat	200	-	-	-	-	-
Wheat bran	50	50	50	50	-	-
Wheat middlings	50	50	50	-	-	-
Soybean oil meal	300	240	240	300	400	400
Dried whey, etc.	30	-	-	-	-	-
Alfalfa leaf meal	50	50	50	70	100	160
Bone meal	-	15	15	30	55	55
Meat and bone scrap	-	-	-	45	-	-
Ground limestone	10	10	20	10	30	20
Salt	4-3/4	4-3/4	4-3/4	9½	9½	9½
Manganese sulphate	1/4	1/4	1/4	½	½	½
Vitamin D-Sup. 85-D	10	10	-	-	-	20
Total Pounds	1000	1000	1000	1000	1000	1000
Total protein %	20.3	17.8	-	21.4	22.7	23.0
Animal protein %	1/3	1.1	-	2½	.0	.0

F. Substitute Feeds that Can be Used

1. Make full use of liquid milk and other animal by-products.

2. Ground soybeans can be used instead of the meal -- although it would not be as patriotic.

3. Condensed or dried milk or whey can be used when available.

4. Defluorinated phosphate can replace bonemeal pound for pound. With a 16% superphosphate use 2 pounds for 1, but not over 4% of ration because of fluorine.

5. If no oyster shells, use agricultural limestone or limestone grit. Not more than 5% of magnesium carbonate.

6. Cut some chicken hay 8-10 inches high and feed in racks.

7. Use good pasture. It saves 10 to 30% of the feed bill.

Reference: Wis. Special Circular -- "Suggested Poultry Rations for 1943" -- June, 1943

CARE AND FEED OF BABY CHICKS

A. Care of Baby Chicks

1. Buy good chicks, well hatched, from high producing flocks near home.

2. Have everything ready in advance and place the chicks under the brooder immediately upon receiving them. Start the brooder stove several days before the chicks are due.

3. Use sand next to the brooder stove and alfalfa or clover chaff, chopped straw, or coarse shavings on the rest of the floor. Be sure that the litter is not musty or moldy.

4. It is true that the rural mail carrier will deliver your chicks, but there is much less chance for the chicks to become chilled if you call for them at the post office or express office immediately upon receiving notice of their arrival. Protect the chicks on the way home if the weather is cold. Cover them but do not smother them.

5. Upon arriving home, if the brooder temperature is not right, it may be best to hold the chicks in the boxes for a short time. Don't overheat or chill them. Have feed and drink available before the chicks are put into the houses.

6. Where chicks are brooded in large lots, it is important to keep them well spread out at night on a dry, clean litter. The litter must not be dusty or dirty. If it is, eye trouble is likely to follow.

7. It pays to clean the brooder house and put in fresh litter as often as needed. This will depend upon the chicks per square foot of floor space.

8. It is a good plan to stir up the litter each day to keep it from packing and let the droppings settle to the floor. Dry litter is very important. Coccidiosis can be partially controlled if the litter is kept dry.

9. Chicks like to pile in corners after they are two or three weeks of age. Therefore, it pays to round off the corners of the brooder house by using either wire netting, roofing paper, or pack the corners with coarse straw or other similar material.

10. A "chick guard" in front of the brooder is desirable. This will help to prevent crowding.

11. The guard should be placed near the canopy when the chicks are small and then gradually moved away from the canopy as the chicks become larger. On cold nights it will be necessary to have the guard closer than on warm nights.

12. The temperature should be kept so that the chicks will be comfortable without crowding, but must not be kept too high. Chicks need a comparatively high temperature for the first day or two. After that, the heat should be gradually decreased.

13. It should be remembered that chicks that run out into the cold need more warmth than chicks running out into a warmer temperature. In other words, when chicks come in from the cold, they should be able to go to a place and get warm and then move back away from the extreme heat to a place that will be comfortable.

14. Locate the brooder at the rear of the colony house. Allow just enough space between the rear wall and the canopy so that one can work comfortably in caring for the chicks. This arrangement will allow for a range in temperature so that each chick will find the best temperature for its age and demands.

15. It should be remembered that the chicks themselves are the best guides on temperature and not the thermometer. If they crowd the stove, give them more heat. It is especially necessary to see that they form a rather wide circle away from the canopy at night. This results in reserved heat so that they can move closer to the stove when it gets colder towards morning. It should be remembered that most people do better brooding when they forget the thermometer and learn to watch the chicks.

B. Feeding Baby Chicks

1. Time of feeding does not affect yolk absorption. Chicks do not die from feeding too early.

2. Home hatched chicks should be taken from the incubator as soon as they are dry and placed in the brooder house with feed and drink available. One of the principle causes of chick losses is that chicks do not learn to eat.

3. Chicks bought from a hatchery should be fed just as soon as they reach the farm. Don't hold chicks beyond 48 hours before feeding. Early feeding does not harm chicks and delayed feeding may injure them.

4. A good plan is to place the first feed of chick mash and grit on pieces of cardboard or other paper. Cut pieces of cardboard about twelve inches square or newspapers and scatter several over the litter in the brooder house. Put some chick size grit and chick mash on these. The chicks running in the paper make a noise that attracts the attention of others and the baby chicks start eating the mash and grit instead of eating the litter.

5. Treat new galvanized dishes - Put in a fountain or fountains of milk. Whole milk is the best, but skimmilk or buttermilk will do if whole milk is not available. When using new galvanized drinking dishes fill them with milk and set in a warm place for two or three days, where nothing can get at the milk. Then pour out the milk, thoroughly wash the dish with warm water and cleansing solution of any kind, then rinse and the most soluble part of the galvanizing will have been destroyed and the dish is safe to use. This is one of the many things that must be done before the chicks arrive.

6. One can use either a simple home made mixture or buy one of the proprietary chick mashes. If you buy a ready-made mash, get the best your dealer has and be sure it is fresh. Last year's mash

may have been in the store for a year and chances are that it is musty and dangerous to use.

7. If you use a home made mixture, remember that the ration must be complete and supply the chicks with material for the rapid building of bone, flesh, and feathers and also supply energy. The Wisconsin Experiment Station has planned a number of simple mixtures that give good results. Any of the following are recommended when feed supplies are normal. For mixtures that are suggested for the present use (1943) see "B" (Suggested Poultry Rations for 1945 under "How to Produce More Eggs").

"80-20"

Ground yellow corn.....	80 lbs.
Pure standard wheat middlings.....	20 lbs.
Oyster shell (chick size)	5 lbs.
Raw bone (chick size) or meat or bone scrap.....	5 lbs.
Salt.....	1 lb.

Skimmilk to drink for first four weeks. After 4 weeks give both skimmilk and water to drink. One pint of cod liver oil or sardine oil for early chicks. Chicks consume approximately 250-300 lbs. of liquid skimmilk while eating 111 pounds of dry mash.

"Wisconsin No. 2"

Ground yellow corn.....	45 lbs.
Pure standard wheat middlings.....	15 lbs.
Pure wheat bran.....	15 lbs.
Meat scraps.....	8 lbs.
Dried skimmilk or dried buttermilk.....	8 lbs.
Alfalfa leaf meal.....	5 lbs.
Hi-calcium limestone grit or chick size oyster shell grit.....	1½ lbs.
Fine gravel or granite grit	1½ lbs.
Salt.....	½ lb.
Cod liver oil or sardine oil (85 A.O.A.C. units) (for early chicks).....	½ lb.

Water to drink

After 4 weeks either give grain or else reduce the amount of milk, and the amount of meat scraps.

"Wisconsin No. 44"

Ground yellow corn.....	45 lbs.
Pure standard wheat middlings.....	15 lbs.
Pure wheat bran.....	15 lbs.
Meat scraps.....	4 lbs.
Dried skimmilk or dried buttermilk.....	4 lbs.
Soybean oil meal.....	4 lbs.
Fish meal..... (Steam or vacuum)	4 lbs.
Alfalfa leaf meal.....	5 lbs.
Hi-calcium limestone grit or chick size oyster shell grit.....	1½ lbs.
Fine gravel or granite grit	1½ lbs.
Salt.....	½ lb.
Cod liver oil or sardine oil (for early chicks)	½ lb.

Water to drink

After 4 weeks either give grain or else reduce the amount of milk, and the amount of meat scraps.

"Wisconsin 30"

Ground yellow corn.....	30 lbs.
Ground barley.....	20 lbs.
Pure wheat bran.....	15 lbs.
Pure starboard wheat middlings.....	15 lbs.
Alfalfa leaf meal.....	3 lbs.
Meat scraps.....	5 lbs.
Fish meal.....	5 lbs.
Dried skimmilk or dried buttermilk.....	5 lbs.
Hi-calcium limestone grit or chick size oyster shell	2 lbs.
Salt.....	½ lb.
Cod liver oil..... (for early chicks)	½ lb.

Water to drink

After 4 weeks either give grain or else reduce the amounts of fish meal, meat scraps, and dried milk.

"Wisconsin 5" - Broiler Ration

Ground yellow corn	40 lbs.
Pure wheat bran	15 lbs.
Pure standard wheat middlings	15 lbs.
Alfalfa leaf meal	5 lbs.
Meat scraps	5 lbs.
Dried milk	5 lbs.
Soybean oil meal	5 lbs.
Fish meal	5 lbs.
Hi-calcium limestone or oyster shell grit	2 lbs.
Fine gravel or granite grit	2 lbs.
Salt	½ lb.
Cod liver oil	½ lb.

Add 4 to 8 oz. of manganese sulphate to a ton of ration.

"Modified 80-20 with Home Grown Grains"

Ground yellow corn	50 lbs.
Ground wheat	30 lbs.
Ground oats or barley	20 lbs.
Salt	1 lb.

Skimmilk to drink for first four weeks. After 4 weeks both skimmilk and water to drink. For use only with chicks in sun on range.

Keep hoppers constantly supplied with feed and drink always available so that the chicks never become too hungry or too thirsty.

8. If white corn is used in place of yellow corn, the ration will not contain enough vitamin A to supply the baby chick's needs. Baby chicks fed entirely on rations made from white corn, oats, skimmilk, etc., will develop eye trouble and die. Green colored alfalfa leaves or other leafy green materials may be used as five or more per cent of the ration to furnish vitamin A. In the summer if the chicks have a good clover, blue grass, or alfalfa pasture, then white corn and similar feeds may be used with satisfactory results.

9. It has been found advisable to give all the feed in clean troughs or hoppers. For starting the chicks the lath trough may be used. The low cost of these should assure the use of a sufficient number to allow all the chicks access to the mash feed. A new supply may be made each season and the old ones used for kindling.

10. After the second or third day the feed troughs and drinking dishes should be placed on a screened platform (1/2 mesh hardware cloth or one inch by one inch firring strips). Feed and drink that is spilled is not available to the chicks and reduces the chances of picking up some types of intestinal parasites.

11. By the time the chicks are a week old switch to larger troughs and then to still larger troughs as the chicks grow. Have trough space enough so that the chicks can all eat at once and never fill the troughs more than half full.

12. At four to six weeks of age the amount of protein should be reduced. When liquid milk is fed, water can be given as an additional drink which will reduce the intake of milk. When the protein feeds are in the mash, e.g., #2; #44; #2X; #2XW, etc., then the protein in the ration is reduced by starting to feed grain along with the mash.

13. Combat intestinal parasites of chicks by paying attention to feeding recommendations and management. Don't place chicks on old range that has been used for years previous or track out to them the parasites from the old flock. Be sure that the chicks have plenty of feed in the late afternoon so that they go to sleep with full crops and then have feed ready for them to eat as soon as they wake up in the morning. This plan helps to reduce lossfrom coccidiosis.

C. How to Avoid Rickets in Chicks

1. If the chicks run out daily into direct sunlight and the ration used is reasonably well supplied with minerals, then leg weakness will not occur.

2. Early in the spring on cold sunny days open the windows so that the sun will shine directly onto the chicks.

3. Whenever possible, begin getting the chicks out-of-doors within the first 3 or 4 days. The most successful chick raisers, as a rule, are those that get the chicks out-of-doors even if the weather is cold.

4. There are numerous vitamin D preparations available. Some of these are dry or powders while others are oils. Either vitamin D oil or powder may be used but should be purchased on a basis of guaranteed A.O.A.C. units of vitamin D.

CULLING CHART

Use the indications grouped below as a yardstick to measure the probable worth of each hen in your flock. Find out:

A. Is She Laying Now?

	Laying	Not Laying
Comb	Large, red, waxy, full	Small, pale, scaly
Beak	Bleached at base	Yellow at base
Abdomen	Full, soft	Shallow, tight
Pelvic bones	Flexible, wide apart	Stiff, close together
Vent	Moist, large, bleached	Dry, puckered, yellow

B. How Did She Lay During the Past Season?

Characteristics useful in spring and summer in judging how long a hen has been laying.

	Long-Time Layer	Short-Time Layer
Shanks	Completely bleached	Yellow
Molt	After August 15	Before August 15
Plumage	Worn	Fresh, loose

C. What About Her Future Laying Ability?

Both hens and pullets can be judged as to prospective value in flock during next laying period.

	Good Layer	Poor Layer
Health	Good -- high vitality	Poor -- low vitality
Temperament	Alert, friendly, active	Dull, listless, or wild
Body	Wide, deep, and long	Narrow, shallow
Head	Large, strong	Shallow & Weak, or coars
Face	Lean, clean-cut	Coarse, wrinkled
Eyes	Bright, prominent	Dull, sunken
Beak	Short, stout	Long, thin
Skin	Soft, thin, silky, loose	Coarse, dry, tight

IMPORTANT FACTORS IN POULTRY HOUSING

1. A 20 x 20 straw loft house will accommodate 150 birds -- an ideal farm flock.

2. A poultry house should be located on well-drained soil, away from the prevailing cold winds, with a southern exposure.

3. The floor should be concreted and constructed so as to avoid dampness as much as possible.

4. A well insulated frame building with 8-foot studdings and a false ceiling is most practical.

5. Insulate walls with waterproof paper on both sides and fill with shavings, sawdust or commercial insulation.

6. A properly constructed straw loft provides insulation, uniform temperature and ventilation.

7. Bafflers replace burlap frames and provide fresh air.

8. Windows should be so constructed and arranged so as to provide sufficient direct sunlight properly distributed.

THE WISCONSIN STRAW LOFT POULTRY HOUSE

A. The Wisconsin straw loft poultry house is particularly well adapted to the climate of our state. Experience with hundreds of these houses in all parts of Wisconsin has proven them to be successful in making it possible to keep laying flocks comfortable and in heavy production in all seasons. Besides being economical and simple to build, this type of house is light, successfully ventilated for moisture control, warm in winter and cool in summer.

No doubt, the success of the Wisconsin straw loft house is due to the straw loft, warm wall construction, size of building, arrangement of roosts, location of window and door openings and the combination of all of these features in one house. While certain of these features may be applied to any house, it is strongly urged that the regular plans be followed in detail to insure best results at the lowest cost.

B. Tests of a Good Poultry House

1. Reasonable in cost
2. Uniform in temperature
3. Large enough for the flock
4. Free from dampness at all times
5. Well ventilated but free from drafts
6. Within easy access of other farm buildings
7. Built to admit direct sunlight into the interior
8. Not shaded by other buildings during the winter.

Reference: Wis. Circular 284 -- "The Wisconsin Straw Loft Poultry House" -- Oct., 1936

SECTION IX - MACHINERY, POWER & LABOR

COSTS OF TRACTOR AND MACHINE USE

Farmers are faced with the job of producing more with less labor and with fewer new machines. The efficiency with which the job is done will depend to a large extent upon good management of power and machinery.

To get the work done properly, better use must be made of tractors and machines now on farms. This may require more custom work, exchange use, and cooperative ownership than usual.

In our present war emergency it is not only a patriotic duty for farmers to cooperate in using their machines to obtain maximum production, but it may be profitable machine management as well. Such increased use will probably not reduce the life of machines materially if properly lubricated, adjusted, and protected.

This has been written:

1. To show why it is sometimes more economical to hire the use of certain machines than to own them
2. To suggest methods of exchanging the use of machines
3. To show how the cost of using a machine may be determined, and
4. To provide normal cost use data for machines commonly used.

NEW MACHINES REDUCE HARD LABOR

There are now on the market two machines that greatly reduce the heavy lifting during silo filling time. Both the Forage Harvester and the Corn Ensilage Harvester replace probably the worst back-breaking jobs on the farm today. The forage harvester may be used both for cutting up the dry hay crop and for ensiling the green hay and, therefore, serving a dual purpose. The corn ensilage harvester replaces both the corn binder and the silo filler although some kind of an elevator must be used in both cases.

The new machine that will soon be on the market will combine both of the above machines. A successful corn attachment has been made that can readily be adapted to the forage harvester. This attachment will save the additional investment in a new ensilage harvester, as well as to materially reduce the amount of labor.

Reference: Minn. Ext. Pamphlet 96 - "Costs of Tractor and Machine Use" - Rev. June, 1943

A. Average Cost of Using Farm Machinery:

	1	2	3	4	5	6	7
Machine	Cost New	Average Life In Years	Repairs As Per Cent Of Cost New	Annual Cost		Cost Per Day (When) Days Used Per Year	
				Total	Per Cent of Cost New		
Tractor plow (2-16").....	$135.00	16	4.5	$ 20.26	15.0	$1.69	12
Tractor plow (3-16").....	170.00	16	4.5	25.50	15.0	2.12	12
Disk harrow (15' single)....	145.00	18	1.0	16.85	11.6	1.40	12
Spike-tooth harrow.....	45.00	20	1.5	4.45	9.9	.45	10
Field cultivator.....	140.00	15	1.5	18.51	13.2	1.30	14
Tractor cultivator 2 row....	110.00	16	2.0	13.37	12.1	.90	15
Tractor cultivator 4 row....	240.00	16	2.0	28.75	12.0	2.90	10
Grain drill tractor hitch 10'	240.00	20	0.5	22.56	9.4	3.75	6
Corn planter 2 row.....	85.00	18	1.5	9.62	11.3	1.60	6
Mower 6 foot.....	95.00	18	3.0	12.17	12.8	1.20	10
Side delivery rake.....	125.00	18	1.0	15.85	12.7	1.98	8
Hay loader.....	140.00	18	1.0	14.94	10.7	1.85	8
Grain binder (Tractor).....	340.00	18	1.5	38.28	11.3	4.80	8
Corn binder 1 row (Tractor).	340.00	18	1.0	35.02	10.3	5.85	6
Combine (6 foot Auxiliary Motor).....	900.00	10	2.0	138.31	15.4	9.25	15
Corn picker 2 row.....	700.00	12	2.0	96.65	13.8	8.05	12
Ensilage cutter.....	325.00	15	2.0	39.88	12.3	5.70	7
Manure spreader.....	160.00	16	1.5	20.12	12.6	.80	25
Pick-up baler.....	900.00	10	3.0	147.60*	16.4	7.38	20
Mower (Tractor).....	130.00	12	4.0	20.93	16.1	1.61	10

* Wire and fuel not included

B. Ways to Use Table:

1. For approximate cost of using a machine for a day, use the figures in column 6.

2. If the cost new of your machine is different from the one given in column 1, multiply the cost new by the percentage figure in column 5. Since this gives the annual cost, divide by the number of days your machine is used per year for the cost per day.

3. To be still more thorough follow the method used in the illustration given in this handbook, substituting your own figures for the estimated life, interest rate, repairs, housing, and amount of use per year.

C. Basis for Figures:

1. The values given in this table for average estimated life (2), repairs as per cent of cost new (3), and days used per year (7) are averages taken from farm surveys.

2. The total annual cost of machine use (4) includes, besides repairs, depreciation, interest, and housing, although these are not shown in the table.

3. The method used in figuring the value of these items was the same as shown in the example for the grain drill.

4. Increased use reduces cost. The cost per day (6) will be less when the machine is used more days per year.

D. Purchase and Use Machinery Wisely:

1. The wise farm manager purchases only those machines that are profitable for him to own. A farmer may wish to use a machine such as a corn picker or a combine, and yet the cost of using it only on his farm might be excessive.

2. Power and machinery costs may represent from one third to one half the total cost of producing small grains and intertilled crops. Therefore, the farm operator should pay particular attention to his machinery needs and to economical management and use.

3. Machines should be available when needed. Since the planting and harvesting seasons are definitely limited, ample machine capacity is necessary to do the work at the proper time. It is convenient to own and use exclusively each machine required on a farm, but often it is not economical.

4. The machine use cost on many farms is higher than it should be, and it could be reduced by increasing the annual use of machines.

5. It is important that a machine be used as many hours as possible during its life to keep down the cost per hour. Many machines are not worn out when they are discarded, but have become obsolete and

have depreciated from exposure and careless handling. Such machines would serve almost as many years if they did the work on two farms instead of on only one.

E. Increase Machine Use:

1. By Custom Work -- The owner not only does his own work but also works for his neighbors at a certain fee per hour or per acre.

2. By Exchanging Machines -- Here one farmer owns certain machines such as a grain binder and corn picker, and another owns other machines such as a silo filler and grain drill with the understanding that each machine will be used by its owner on both farms.

3. By Cooperative Ownership -- Cooperative ownership is practiced in some cases, but in general is not as common as the other two methods.

Factors fundamental to the success of using machines on two or more farms are:

a. A machine should be operated by its owner or someone hired by him.

b. Farmers must be willing to cooperate and to adjust their work schedule to the availability of machines.

c. There must be a definite understanding with regard to charges and payments for the use of machines. Rates should be decided upon beforehand and settlement should be made frequently.

F. Figure Your Tractor Costs:

To determine tractor use costs, it is necessary to know the first cost, the estimated life in years, the rate of interest, and the amount of use per year. In the following example we assume that the first cost is $900.00, estimated life is 12 years, rate of interest is 6 per cent, and annual use is 450 hours. We further assume that the tractor has a drawbar rating of 16 horsepower, that the fuel consumption is 1.6 gallons per hour, that the cost of lubricants is $2\frac{1}{2}$ cents per hour, and that the annual cost of tractor repairs is 2 per cent of the cost new.

Tractor costs may be divided into "fixed charges" and "operating costs". The fixed charges are those that remain relatively unchanged regardless of the actual number of hours of use per year. The operating costs are those that occur only when the tractor is operating.

1. Depreciation -- Annual depreciation is the first cost divided by the estimated life in years or in this example $900.00 divided by 12 which equals $75.00. In estimating the life, assume a conservative life in keeping with conditions under which the machine will probably be used.

2. Interest -- Interest is computed on the investment, which decreases as the machine depreciates. To determine in advance the annual in-

terest cost of using a new machine, multiply the interest rate by the average value of the machine which is about one half the first cost. For the tractor in our example, this would be 6 per cent of $450.00 or $27.00.

3. Housing -- The annual charge for a shelter including depreciation and upkeep is about 10 per cent of the first cost. For a shelter of about 1,000 square feet costing $300.00 to build, the annual charge would be $30.00, and the cost per square foot would be 3 cents. If the tractor occupies an area about 14 x 7 feet or 98 square feet, the annual cost of housing is $2.94.

4. Summary of Tractor Costs

a. Fixed Charges (per year)

Depreciation	$ 75.00	
Interest	27.00	
Housing	2.94	
Total	$104.94	
Fixed costs per hour ($104.94 ÷ 450)		$0.233

b. Operating Costs per hour

Fuel - 1.6 gallons at 14¢	$0.224	
Lubricants (cylinder oil, transmission oil, and grease)	.025	
Repairs (at 2 per cent of cost new per year)	.04	
Total operating costs per hour		0.289
Total Cost Per Hour		$0.522

C. Figure Your Machinery Costs:

1. The cost of using any farm machine may be found in a manner similar to above. Depreciation, interest, repairs, and housing are usually considered for machinery. In the example below we use a grain drill 10 feet wide costing $240.00. We assume the life to be 20 years; the interest rate, 6 per cent; the annual acreage covered, 90; and the acres seeded per day, 15.

2. The annual costs are as follows:

Depreciation ($240 ÷ 20)	$12.00
Interest ($120 x .06)	7.20
Repairs (½ per cent of cost new)	1.20
Housing (72 square feet x $0.03)	2.16
Total	$22.56
Cost per acre ($22.56 ÷ 90)	0.25
Cost per day ($22.56 ÷ 6)	2.76

3. Depreciation is the largest item of fixed costs in machinery use. Annual depreciation can be reduced by increasing the useful life

of a machine by better care, more timely repairing, proper adjustments, adequate lubrication, and shelter.

4. The costs per hour can be reduced further by using the machine more hours each year.

H. Hourly Cost of Tractor Use:

The following tractor cost data are averages from records kept by farmers for two years on different sized tractors. While the actual cost of operating a particular tractor depends on many factors, these costs are close to what they would be for average use.

Drawbar Horsepower of Tractor	Cost Per Hour		
	Fixed	Operating	Total
5.5 - 12.0....	.24	.18	.42
12.0 - 18.5....	.26	.26	.52
18.5 - 25.0....	.29	.33	.62
25.0 - 31.5....	.47	.48	.95

I. Total Cost of Field Operations:

1. To determine the cost of performing any field operation, find the cost of the power, the machine, and the labor to run the outfit and add them together.

2. For example, to find the cost per acre to operate a 16-horsepower tractor with a 2-bottom plow, first figure the cost per hour to operate the tractor and the machine. For approximate values use the figures shown in the table above for a 16-horsepower tractor and in the table on the previous pages for a 2-bottom plow and add to these the cost per hour for labor. Using the figures in the tables and assuming a labor charge of 55 cents an hour, the cost per hour would be 52¢ + 18¢ + 55¢ = $1.25. Plowing an average of four-fifths acre per hour, the cost per acre would be $1.56.

J. Fair Rental Rates:

A fair rental charge for a machine varies with conditions. If the machine is operated by the owner or someone hired by him the risks of damage need be no greater than on his own farm. If, however, the machine is turned over to the person hiring it to use as he sees fit, the owner is perhaps justified in adding a margin above actual use costs. Unusual or severe operating conditions may affect the rate charged. If the machine is hired for a short time only, the rate may be higher than if it is hired for a longer period. The person hiring the machine ought to pay transportation.

Reference: Minn. Ext. Pamphlet 96 - "Costs of Tractor and Machine Use" - Rev. June, 1943

COST OF CUSTOM WORK ON WISCONSIN FARMS, 1942

Cost of Combining Grains and Seeds	Per Bushel	Per Acre	Per Hour
Grain Crops			
Oats	.043	2.90	2.97
Wheat	.058	2.90	3.01
Barley	.046	2.90	2.99
Rye	.056	2.96	3.01
Buckwheat	.058	2.98	2.92
Flax	.130	3.25	2.96
Soybeans	.25	2.88	2.93
Seed Crops			
Clover seed	1.82	3.04	3.06
Timothy seed	1.02	3.02	3.02
Alfalfa seed	1.94	3.02	3.06
Sweet clover seed	1.64	3.18	2.91
Cost of Custom Work Hired			
Plowing		1.98	1.73
Field cultivating or quack digging		.98	1.71
Discing		.79	1.69
Planting corn		.80	1.22
Cultivating corn		.75	1.40
Seeding grain		.76	1.33
Mowing hay		.81	1.36
Cutting grain		1.35	1.58
Cutting corn		1.72	1.72
Picking corn by machine	.064	3.01	3.09
Digging potatoes by machine	.077	3.21	2.05
		Per Ton	Per Hour
Baling hay in fields		2.49	2.82
Baling hay in barn		2.18	2.52
Putting up hay with buck rake		1.96	2.18
Filling silos (with cutter and tractor)			2.54
		Per Day	Per Hour
Trucking, including both truck and driver			
½ to 1½ ton truck		13.15	1.51
Over 1½ ton truck		16.82	1.90
		Per Cwt.	Per Bag
Grinding feed			
At custom mills		.094	.079
By portable mills at farm		.101	.092

FARM MACHINERY RENTAL CHARGES IN WISCONSIN, 1942

Kind of Machine	Rental Charges		
	Per Hour Dollars	Per Day Dollars	Per Acre Dollars
Tractors			
Small, 1-plow	1.07	9.61	1.60
Light, 2-plow	1.35	12.45	1.69
Heavy:			
2-plow	1.50	14.30	1.78
3-plow	1.91	16.43	1.80
Plows			
Horse, sulky, 1-bottom	.14	1.15	.38
Horse, gang, 2-bottom	.24	1.65	.50
Tractor:			
1-bottom	.31	1.50	.54
2-bottom	.48	2.86	.55
3-bottom	.62	3.77	.68
Disc harrows			
Horse, single, 6 to 8 feet	.22	1.40	.31
Tractor:			
Tandem, 8 feet or less	.44	2.31	.43
Tandem, over 8 feet	.52	3.33	.54
Single, 16 feet or less	.42	3.05	.42
Single, over 16 feet	.59	3.08	.33
Corn cultivators			
One-row, horse	.25	1.01	.27
Two-row, horse	.41	1.54	.31
One-row, tractor and cultivator	1.09	9.36	.76
Two-row, tractor and cultivator	1.63	14.75	.75
Two-row rotary hoe	.37	2.90	.39
Other machines			
Field cultivator or quack digger, 7 to 9 ft.	.47	1.95	.44
Grain drills:			
8 feet or less	.38	2.02	.40
Over 8 feet	.60	2.59	.53
Corn planters:			
2-row, horse	.33	1.78	.35
2-row, tractor	.50	2.44	.35
4-row, tractor	.73	5.00	.33
Corrugated roller	.27	1.31	.22
Corrugated roller with grass seeder	.31	2.21	.33
Binders			
Grain:			
Horse	.64	3.55	.80
Tractor	.93	5.62	1.05
Corn, 1-row:			
Horse	.69	4.69	.87
Tractor	.91	5.81	1.22
Ensilage harvester	2.94	21.25	4.10

FARM MACHINERY RENTAL CHARGES IN WISCONSIN, 1942
(Continued)

Kind of Machine	Rental Charges			
	Per Hour	Per Day	Per Acre	Per Bushel
Hay machines				
Mower, horse-drawn	.42	1.77	.43	
Mower and tractor	1.69	14.64	1.35	
Side rake	.30	1.64	.31	
Buck rake and tractor	2.00	17.50		
Hay loader	.34	1.91	.42	
Pick-up baler	3.09	30.50	3.16	
Stationary baler	2.07	18.33	2.25	
Field hay chopper:				
4 feet or less	2.58	26.67	3.75	
Over 4 feet	4.10	42.50	4.62	
Potato diggers				
1-row:				
Horse	.66	2.33	.82	
Tractor	1.30	2.25	1.42	
2-row, tractor	1.81	2.00	1.62	
Corn pickers				
1-row and tractor	2.83	20.00	2.83	.05
2-row and tractor	3.56	36.75	2.98	.06
Combines				
4 feet or less	2.38	20.83	2.79	.05
5 and 6 feet	3.16	29.17	2.95	.06
	Per Hour	Per Day	Per Ton	
Ensilage cutters				
12 inches or less	1.27	10.07	.26	
Over 12, less than 16	1.77	14.14	.22	
16 inches and over	2.17	15.81	.20	
Spreaders				
Lime	.32	1.58	.22	
Manure				
Horse-drawn		1.82		
Tractor-drawn		2.29		
Wagons				
Rubber tires, 4 wheels		1.01		
Steel tires, 4 wheels		.73		

ANNUAL COST OF OPERATING FARM MACHINES IN WISCONSIN

Machine	No. of Mach.	1st Cost $	Years Total Life	Housing Cost	Dep. Cost	Dep. % of 1st Cost	Repair Cost	Repair % of 1st Cost	Int. and Ins.	Total Annual Cost	No. Acres Worked	No. Hours Used	Machine Only: Cost per Acre	Machine Only: Cost Per Hour	Costs Including Power & Operator: Acre	Costs Including Power & Operator: Hour
Fuel cost																
Tractor 133.64	190	929	12	4.13	90.58	9.7	23.01	2.5	31.12	282.48	316	620	.89	.46		1.00
Silage Cutter	143	346	20	2.14	19.54	5.6	7.14	2.0	10.44	39.26	tons 184	44	ton .21	.89		1.90
Thresher	45	1130	22	6.88	53.05	4.7	19.94	1.8	32.29	112.16	bu. 7998	88	bu. .01	1.28		2.30
Combine	21	661	7	4.17	68.01	10.0	18.71	2.8	19.67	110.56	85	91	1.30	1.21	2.40	2.20
Shredder	22	696	19	3.60	52.67	7.5	10.18	1.5	21.26	87.71	bu. 3792	73	bu. .02	1.20		2.20
Corn Picker	9	701	14	4.38	50.06	7.1	14.50	2.0	15.48	84.42	112	135	.75	.62	2.25	1.75
Tr. Corn Binder	18	331	15	2.84	22.09	6.7	7.43	2.2	10.08	42.44	32	45	1.33	.94	2.65	1.90
Tractor Plow	174	116	17	2.63	8.18	7.0	6.48	5.6	3.59	20.88	66	92	.32	.23	1.75	1.25
Tractor Disc	110	113	20	2.24	6.25	5.5	1.98	1.7	3.21	13.68	77	44	.18	.31	.75	1.30
2-Row Cultivator	114	133	14	2.73	9.83	7.4	1.37	1.0	3.84	17.77	97	86	.18	.21	1.10	1.25
Corrug. Roller	80	79	24	1.23	3.89	4.9	.73	0.9	2.41	8.26	53	30	.16	.28	.75	1.25
Field Cultivator	73	120	18	3.60	6.64	5.5	2.75	2.3	3.43	16.42	96	58	.17	.29	.90	1.30
Spring. Harrow	126	42	22	1.71	2.27	5.4	1.28	3.0	1.26	6.52	66	42	.10	.15	.75	1.15
1-Row Cultivator	116	65	20	1.45	3.34	5.1	1.34	2.0	1.89	8.02	39	68	.21	.12		
Corn Planter	175	94	25	1.22	4.79	5.1	1.48	1.5	2.86	10.35	33	32	.31	.32		
Grain Drill	168	154	24	2.10	7.45	4.8	.87	0.5	4.52	14.94	38	32	.39	.46	1.25	1.50
Lime Sower	60	51	16	1.36	3.52	6.9	.83	1.6	1.46	7.17	43	44	.17	.16		
Manure Spreader	184	170	16	4.22	12.32	7.2	3.60	2.1	5.09	25.23	37	177	.68	.14		
Grain Binder	168	193	25	3.41	8.27	4.2	5.30	2.7	5.71	22.69	31	33	.73	.69	1.90	1.70
Horse Corn Binder	179	207	20	2.81	10.51	5.0	5.76	2.8	5.92	25.00	19	31	1.30	.81	2.90	1.80
Mower	214	91	21	1.09	5.45	6.0	3.62	4.0	2.73	12.89	46	49	.28	.26	1.25	1.25
Side Rake	171	111	21	4.22	5.77	5.2	1.89	1.7	3.38	15.26	51	36	.30	.42		
Buck Rake	15	50	20	4.34	4.85	9.7	.15	0.3	1.53	10.87	24	20	.45	.56		1.50
Hay Loader	180	124	22	4.67	6.48	5.2	1.71	1.4	3.92	16.68	48	55	.35	.30		
Milker	129	306	18	--	17.04	5.5	9.52	3.1	7.86	34.42	cows 22	736	cows 1.59	.05		
Farm Feed Mill	62	79	19	--	6.01	7.6	2.27	3.0	2.96	11.24	bu. 1571	72	bu. .01	.16		1.20
Pick-up Baler	3	675	14	5.57	52.08	8.6	1.67	0.3	20.05	79.37	ton 47	49	ton 1.70	1.62		2.50

Reference: College of Agriculture, University of Wisconsin

ESTIMATED ANNUAL AND DAILY COST AND USE OF FARM MACHINE SERVICE (IOWA)

Machine	Aver. 1941 Price	Aver. Life Years	Annual Depreciation and 5% Interest	Annual Cost of Repairs	Annual Cost Housing Insurance Taxes	Total Annual Cost	Aver. Annual Use Days	Cost of Service per Day
Tractor plow.....	$110	17	$ 9.79	$ 3.85	$ 2.20	$ 15.84	16	$1.00
Disk harrow.....	85	18	7.22	1.28	1.70	10.20	14	.75
Spike T. harrow.....	50	22	3.80	.75	1.00	5.55	10	.55
Spring T. harrow.....	55	21	4.35	1.10	1.10	6.55	7	.95
Broadcast seeder.....	28	21	2.22	.42	.56	3.20	3.5	.95
Grain drill.....	210	28	14.05	2.10	4.20	20.35	5.5	3.70
Corn planter.....	85	21	6.63	1.28	1.70	9.61	6	1.60
1-R cultivator.....	55	24	3.96	1.10	1.10	6.16	10	.60
Tr. cultivator.....	120	15	11.50	2.40	2.40	16.30	17	.95
Rotary hoe.....	100	18	8.50	1.00	2.00	11.50	5.5	2.10
Mower.....	100	21	7.90	3.50	2.00	13.40	9	1.50
Hay rake.....	55	28	3.69	.83	1.10	5.62	5	1.15
Sweep rake.....	60	19	4.98	1.20	1.20	7.38	5	1.45
Side delivery.....	120	21	9.48	1.20	2.40	13.08	6.5	2.00
Hay loader.....	135	21	10.65	1.35	2.70	14.70	8	1.85
Grain binder.....	270	24	19.41	5.40	5.40	30.21	5	6.05
Corn binder.....	250	21	19.75	5.00	5.00	29.75	5	5.95
Combine.....	650	11	78.00	16.25	13.00	107.25	22	4.90
Corn picker.....	750	12	84.00	11.25	15.00	110.25	14	7.90
Feed grinder.....	150	19	12.44	2.25	3.00	17.59	13	1.35
Ensilage cutter.....	325	18	27.60	6.50	6.50	40.60	7	5.80
Manure spreader.....	170	18	14.45	2.55	3.40	20.40	28	.75
Tractor.....	850	14	83.20	8.50	17.00	108.70	79	1.40
Truck.....	950	15	91.20	28.50	19.00	138.70	55	2.50
Wagon.....	120	30	7.80	2.40	2.40	12.60	37	.35
Trailer.....	100	28	6.70	5.40	2.00	14.10	9	1.55
Portable elevator.....	275	26	19.25	2.75	5.50	27.50	12	2.30
Windmill.....	80	32	5.04	.80	1.60	7.44	149	.05
¼ H.P. elec. motor....	15	24	1.08	.30	.30	1.68	31	.05
½ H.P. elec. motor....	45	30	2.92	.45	.90	4.27	47	.09
1 H.P. elec. motor....	65	30	4.22	.33	1.30	5.85	43	.14
5 H.P. elec. motor....	175	30	11.37	.18	3.50	15.05	14	1.10

Source: Iowa Bulletin P37 (new series) from Table 5.

Note: Farms average 254 acres in size with 185 crop acres.

MAKE A CHECK LIST OF NECESSARY MACHINERY REPAIRS

It is the job of the supervisors to assist borrowers in finding out precisely what repairs are necessary. Here's a check list of repairs that has been prepared which might make a good reminder sheet for farm families in your areas.

Plow	Points should be sharp and should be polished and oiled (or greased). In rocky and stumpy areas one extra set should be kept on hand. The moldboards should be checked and replaced if worn badly. If not replaced they should be oiled and polished. Landsides should be replaced if badly worn; wheels and coulters should be inspected; and all bolts tightened or replaced.
Springtooth and Spiketooth harrow	Check all teeth, levers, and tighten bolts -- sharpen teeth if dull.
Disc harrow	Check bearings for wear -- replace if necessary. Sharpen discs (except cutaway) and check levers and hitch.
Drills and Planters	Check and clean fertilizer and seed compartment. Check all gears, chains, shovels, or discs, and spouts -- oil and grease.
Lime sower	Clean, adjust, grease and oil.
Cultivator	Align and adjust frame and sharpen teeth, hoes, discs and wings (guards).
Binders	Sharpen or replace knives, inspect gears and bearings, straighten and tighten guards, adjust knotter, oil and grease.
Mower	Inspect pitman rods, knives, guards. Replace badly worn or broken knives and guards, wearing plates, knife guides and serrated guard plates.
Rake	Straighten or replace teeth, repair shafts, adjust or repair gears.

Loader	Repair slats, ropes, forks, shafts and hitches.
Diggers	Sharpen or replace shovel, inspect and adjust carriers, chains, and gears -- grease and oil.
Wagons	Set wheels, repair poles and reaches -- grease.
Hay rack or Rigging	Inspect and repair -- replace broken boards.
Sprayer	Inspect pumps and leathers and adjust. Inspect nozzles and clean or replace if necessary. Check rubber hose for replacement, tighten tank and repair leaks -- grease and oil.
Duster	Check the blower, clean outlets, grease and oil.
Spreader	Inspect chains, gears, aprons -- replace worn or broken parts -- grease and oil.
Harnesses	Repair and oil.
Collars	Repair and fit correctly.
Ensilage cutter	Check conveyor chains, gears and cutting bar for wear -- adjust and replace parts needed -- sharpen knives and adjust
Tractor	General checkover, check carburetor and fuel lines for leaks -- check motor for leaking gaskets, replace where necessary -- check rubber tires, tighten lugs or steel wheels, check front wheel bearings for wear and alignment, replace parts if needed.

ENTERPRISE LABOR REQUIREMENTS

From Minnesota Technical Bulletin 44 we list here a table which should help in reckoning labor needs for planning purposes.

LABOR REQUIREMENTS OF ENTERPRISES PER YEAR

Item	Per	Number of Minimum Days of Productive Work
Dairy Cows	Cow	16.6
Other Dairy Cattle	Animal Unit*	7.6
Sheep	" " *	2.7
Poultry	100 hens	20.1
Hogs	100# Produced	.55
Turkeys	" "	.8
Alfalfa	Acre	1.5
Other Hay	"	.6
Small Grain & Flax	"	1.0
Canning Peas	"	2.5
Sweet Corn	"	3.0
Corn for Grain		
Husked	"	2.1
Husked & Shredded	"	2.8
Corn for Silage	"	2.6
Corn for Fodder	"	1.8
Potatoes	"	6.4
Sugar Beets	"	4.0

* Animal Unit represents one cow, one bull, 2 head young cattle, seven head of sheep, 14 lambs, five hogs, ten pigs, 100 hens or 1400# produced turkeys.

SECTION X - FARM FORESTRY

(Continued)

THE FARM WOODLAND

Because the production of wood and wood products, as a continuous crop, offers excellent opportunities for returns to owners from those lands not suited for grain, hay, pasture or row crops, the farm woodland should be managed as a part of the successful farm enterprise.

Woodland Management

Woodland management involves the growing, reproduction and harvesting of stands of timber on a permanent basis. It aims to establish trees if they are not present, or, if they are present, to improve their quality and insure a continuous yield.

The ideal farm woods is a community of small, intermediate and large-sized trees. The owner of such a woodland simply harvests the older trees annually or periodically and permits the younger trees to occupy the ground where the larger trees grew. He is maintaining his wood's capital and is insuring a continuous yield.

The only real problem he has is to secure the right kind of trees in the young age classes in order that the future stand will not be a community of worthless species.

Natural Reproduction

In general, one of three methods of cutting will give the desired results for obtaining natural reproduction. Namely:

Selection:

Only scattered mature trees are cut. Thus no part of the ground larger than the crown of a single tree or two is exposed.

Group Selection:

A modification of the above, in which several large, though not necessarily mature, trees are cut on one area. Obviously this results in larger openings than when a single tree is removed. The openings should not exceed half an acre, preferably less.

Clear-cut:

All usable trees, regardless of size, are cut on the area.

Although the amount of seed available at the time of cutting, a number of site factors, and the condition of the stand, all influence the kind of reproduction obtainable, the following may be used as general guide to what can be expected in Wisconsin from each of the three methods:

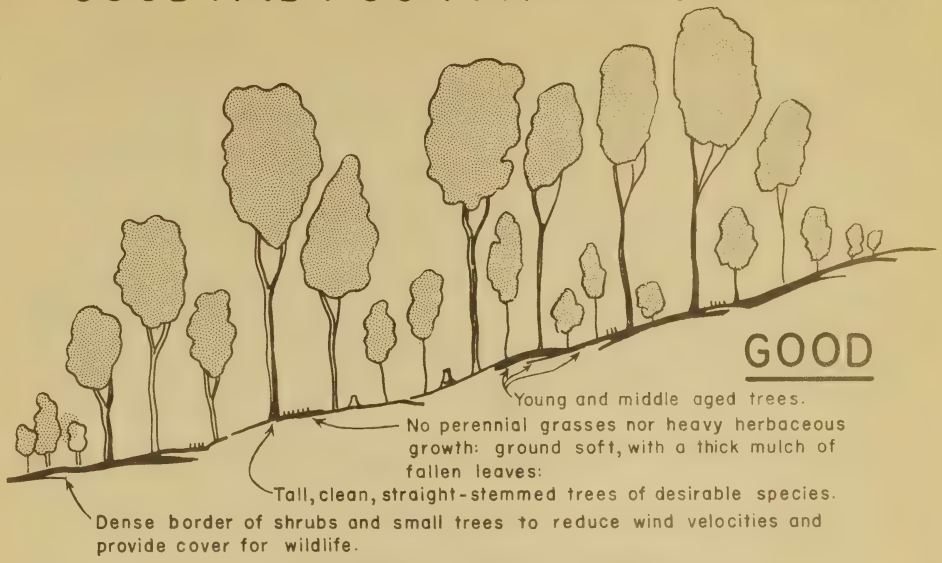
METHODS OF CUTTING FOR NATURAL REPRODUCTION

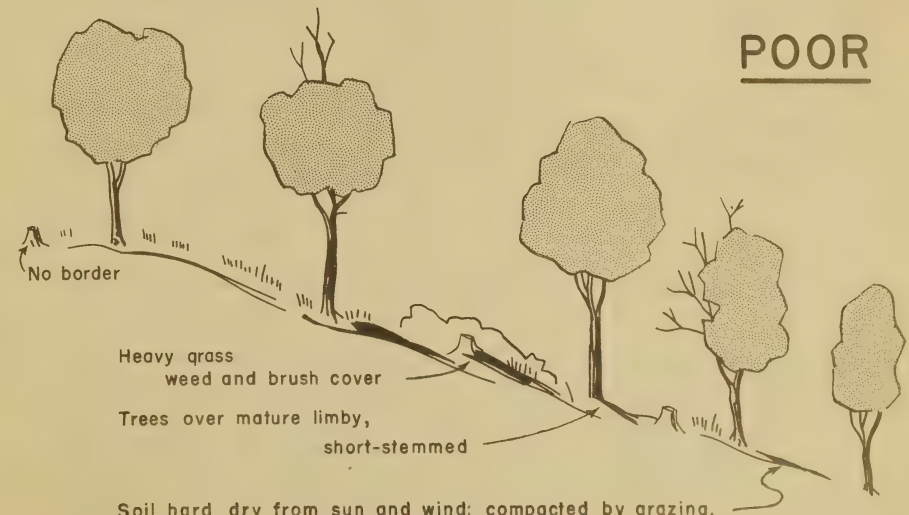
Method	Probable Resulting Reproduction, Assuming Seed Trees to be Present	Remarks
Selection	Hard maple; basswood; Elm; black cherry; hickory; white ash; tolerant shrubs.	Only method recommended on steep, southerly-facing slopes. Intolerant species ordinarily will not reproduce satisfactorily.
Group Selection	All oaks, black walnut; pines	Use on east, north, west slopes, or flats, where desired reproduction is intolerant. Too large openings on dry sites will encourage site deterioration, and only brush and weeds will come in.
Clear-cut	Sprouts of existing hardwood species; light-seeded trees such as aspen, elm, box elder; shrubs; briars; herbaceous plants.	Generally not recommended for farm woods. May be necessary on small areas in order to secure sprout reproduction where there is a heavy undergrowth of shrubs and undesirable species. Black locust, catalpa, osage orange, and jack pine* may be reproduced by clear cutting.

* In addition to heavy cutting, the exposure of mineral soil and the lopping and scattering of the cone-bearing tops is necessary for the reproduction of jack pine.

References: USDA Farm. Bull. 1177 - "Care & Improvement of the Farm Woods"
USDA Bull. 1117 - "Forestry and Farm Income"
Wis. Ext. Cir. 305 - "Woodland Improvement" - Rev. Mar., 1941

GOOD AND POOR FARM WOODLAND





PLANTING

In general, in Wisconsin both fall and spring plantings are satisfactory although spring planting is favored. Depending on whether the season is early or late, trees ordinarily should be planted just as soon as the frost is out of the ground. Planting should be done when trees are dormant.

Usual spring planting dates approximate:

April 10 - May 15 for the Southern half of the State
April 20 - May 20 for the Northern half of the State

Planting usually presupposes some future utilization of the trees after they are mature; hence, the prospective tree planter wants to know what a mature tree is good for and its relative growth rate. The first consideration is the site where the trees are to be planted; regardless of what the potential value of a certain species may be, if the site is not right, it will be futile to plant it.

Spacing to be Followed in Forest Plantations:

Trees Required Per Acre When Spaced				
12 by 12 feet Number 303	8 by 8 feet Number 680	6 by 6 feet Number 1,210	5 by 5 feet Number 1,743	4 by 5 feet Number 2,178
Cottonwood, (black walnut 30 or 40 feet apart).	Yellow poplar, White ash.	White pine, red pine, jack pine, red oak, black oak, black locust.	Hickory, white oak, bur oak, post oak, elm, basswood*	Sugar maple, yellow birch beech, white spruce, Norway spruce, fir*

* The species in the last two columns of the table can withstand considerable shade without being killed.

Trees for Various Uses

Posts	Fuel	Ties
Osage Orange Black Locust White Cedar Red Cedar Catalpa Bur Oak White Oak Honey Locust	Hard Maple Oaks Hickory Ash All species in proportion to weight of their wood	Bur Oak Black Locust White Oak Red Oak Black Oak Cedar Pines (except white)

Trees for Various Uses (continued)

Veneer Bolts	Lumber	Windbreaks
Black Walnut	White Pine	White Spruce
White Oak	Red Pine	Blue Spruce
Soft Maple	Black Walnut	Black Hills Spruce
Cottonwood	White Oak	Norway Spruce
Red Oak	Red Oak	Douglas Fir
Elm	Bur Oak	White Pine
	Cottonwood	Norway Pine
	White Ash	Austrian Pine
	Green Ash	White Cedar
Christmas Trees		Mulberry
Douglas Fir		
White Spruce		
Norway Spruce		
Black Spruce		
Balsam		

Assuming adaptability to the site and complete recovery from the shock of planting, the trees commonly planted in Wisconsin may be grouped in three classes to indicate their relative rates of growth.

Relative Growth Rates:

Rapid	Medium	Slow
Scotch Pine	White Pine	Austrian Pine
Jack Pine	Red Pine	Spruce
Willow	Black Walnut	Red Cedar
Cottonwood	Plum	All Oaks
Black Locust	Black Cherry	
	Ash	

References: Wis. Cir. 287 - "Shelterbelts for Windblown Soils" - Rev. Jan., 1941
Wis. State Cons. Dept. - "Forest Planting Handbook" - 1937
USDA Farm. Bull. 1405 - "The Windbreak as a Farm Asset"
USDA Farm. Bull. 1453 - "Growing & Planting Coniferous Trees on the Farm"
USDA Farm. Bull. 1123 - "Growing & Planting Hardwood Seedlings"

UTILIZATION OF FORESTRY PRODUCTS

The farm woods should be considered in the same manner as other cropland or meadows; its products are to be harvested, used on the farm, or marketed similar to any other crop only the method is different.

The first requirement of a farm woods is that it provide as much as possible of the wood products needed for home use. In Wisconsin, the average farm uses in a normal year:

Kind	Amount	Average Value
Fuelwood	10 to 20 standard cords (30 to 60 cords of block wood)	$ 75.00
Fence posts	100 to 200 posts	22.00
Lumber	500 to 1000 board feed	30.00
		$127.00

This represents the amount of timber that will grow each year on 25 to 30 acres, provided the woods have not been over-cut, burned or used for pasture. If your woodlands grow each year more timber than is required to supply your yearly needs for firewood, posts, repairs and what is needed as a reserve for future construction, then you may be interested in timber marketing and harvesting.*

A. Harvesting:

1. Keep the immature, full-crowned, rapidly growing trees of desirable species undamaged by cutting operations.

2. Plan utilization in accordance with the size, form, condition and species of trees to be cut. For example, the poorest formed hickory, hard maple and black oak would be used for fuel instead of straight, clean, rapidly growing white oak and walnut.

3. If possible, plan cutting and roads so that products may be moved downhill. Most forest products are bulky and their movement puts a big strain on the farm equipment ordinarily available.

4. Harvesting is best done in the late fall, winter, and early spring. Teams and farm labor are not so busy, the weather is better suited to chopping, sawing, felling, and skidding timber, and the timber itself saws and splits and seasons better. However, when the product is to be peeled as in piling and pulpwood, spring is the most satisfactory season for harvesting.

5. If the product is to be sold, specifications of product should be known when the trees are harvested.

* The material contained in this section is intended for the farmer who has timber in excess of home requirements.

B. Marketing:

Lack of information on the value of timber products and kind and specifications of timber purchased by different markets results in thousands of dollars of loss every year.

Many sell high grade trees for a lump sum to the first buyer that comes along, while others attempt to dispose of products that do not meet buyers' specifications, and as a result lose their time and labor.

It is to the borrower's advantage to sell products, not stumpage. The total value of timber products laid down at the mill or other point of utilization can be approximated as follows:

Stumpage (value of standing timber)	13 per cent
Cutting (felling, bucking, splitting, peeling)	40 " "
Skidding and decking	12 " "
Hauling, loading and unloading	35 " "

1. Be sure there is something to sell. Many farm woods will produce no more timber than is needed for home use. Never sell more than accumulated annual growth.

2. Timber should not be cut until the market is located and an agreement made on its disposal.

3. Competition among buyers should be encouraged.

4. Sell direct to user if possible. Obviously this is one of the advantages offered through cooperative selling.

5. Unless in dire financial straits, farmers should not be overanxious to sell sound trees. Timber standing in well-managed woods does not deteriorate rapidly; in fact, its value will increase, as shown in the following comparison:

Diameter Inches	Merchantable Height-Feet	Board Foot Volume		Stumpage Value*
12	20	61	@ $4.00 per M -	$0.24
16	30	156	@ 6.00 per M -	.94
20	40	337	@ 8.00 per M -	2.70

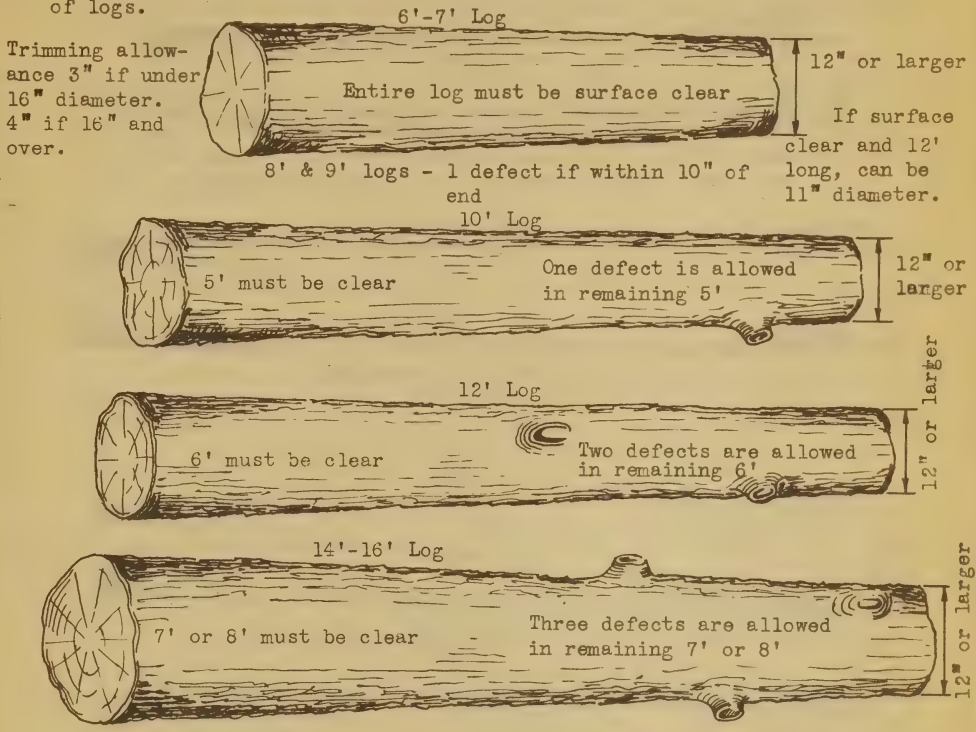
Or, stated in another way, a thrifty tree will treble in value every 15-20 years. Trees below 14" probably will not pay the cost of harvesting for saw timber.

6. Investigate responsibility of buyer and get a written contract.

* Value of trees on the stump - standing in the woods.

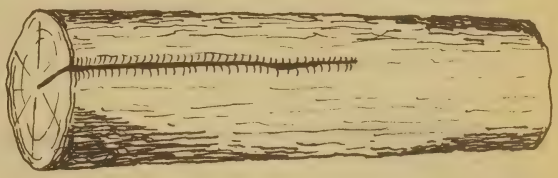
O.P.A. SPECIFICATIONS FOR VENEER OR GRADE NO. 1 LOGS

All logs shall be cut from live timber 12" and larger in diameter at the small end. Logs may be cut in 10, 12, 14, or 16 foot lengths. Logs 6', 7', 8', and 9' long may be cut but are optional with buyers. Below is diagrammed the maximum number of defects allowed in the various lengths of logs.



The defects indicated may consist of knots, worm holes, cat faces, dead or dozy spots, bird pecks, brown spots, pin-holes, or seams.

In logs 12"-14" in dia., a hole in the heart of a log not to exceed 3" in diameter is allowed. In logs 15"-16" dia. a 5" hole allowed. In logs over 16" -6" hole allowed.



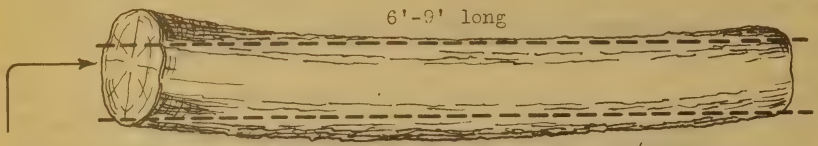
One tight straight seam is permitted in a log 16" and over in dia. No seam allowed in logs 15" diameter or smaller.

(over)

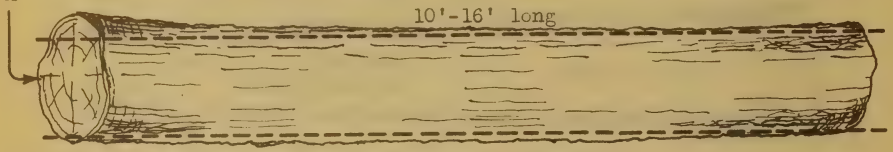
C.P.A. SPECIFICATIONS FOR VENEER GRADE LOGS (CONT.)

MAPLE LOGS

$\frac{1}{2}$ of diameter of small end may be black heart or mineral stain

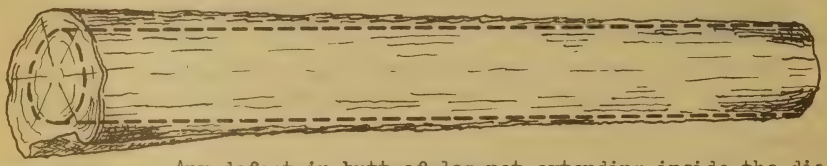


Sweep in logs 6'-9' long allowed up to 1/6 of dia. of small end. Sweep measured from above butt swell.



Must be reasonably straight

Spiral grain allowed if not more than 1" in 10"



Any defect in butt of log not extending inside the dia. represented by the small end will not be considered in grading the log.

Crotches, crooks, or kinks, are to be scaled out when so located that a veneer log can still be obtained.

KINDS OF PRODUCTS NEEDED

A. Veneer Logs:

The most commonly used trees for veneer in Wisconsin are red oak, elm, maple, white oak, birch, black walnut, and basswood, although a few buyers take some of the other species. Inasmuch as veneer is manufactured for a large number of purposes no standard specifications can be given, but the accompanying illustration shows a number of the usual requirements of good veneer logs.

No standing trees below 16" in diameter* will be worth much as veneer timber; a study of the typical specification shows that even in larger sizes the market demands logs that are free from large knots, crooks, rots, etc. Logs less than 12" in diameter at the small end usually are not acceptable.

The range of prices paid per 1000 board feet is as follows:

1st Quality Logs f.o.b. cars			2nd Quality Logs f.o.b. cars		
$26.00	to	$67.50	$15.00	to	$24.00

A complete list of wood-using industries can be had at all county agricultural agents' offices, or in the district Soil Conservation offices. The extension foresters issue semi-annually reports on current log, lumber and stumpage prices in the state, copies of which may be had by consulting the county agent or writing the Extension Forester, College of Agriculture, Madison.

B. Saw Logs:

Logs that are to be sawed into lumber are called "saw logs". Every kind of tree that is large enough to make a board is usable for some purpose or other. However, the most readily marketable species are: white and red pine, hemlock, white oak, black walnut, red oak, maple, birch, basswood and ash.

Pine logs as small as 6 to 8 inches at the top end may be acceptable but the buyers of logs of other species generally require that logs be at least 10 to 12 inches. This means that it doesn't pay to cut for sawlogs standing trees that are less than 14 inches in diameter. The buyer's requirements as to length also must be known, although most logs are cut in 8, 10, 12, 14, or 16 foot lengths. In addition three to four inches must be allowed to take care of squaring up and trimming off the defects on the ends of the resulting boards.

C. Railroad Ties:

Oak, both red and white, is the species most used for railroad ties in Wisconsin; in fact, there are more of these species cut than all other kinds of tie timbers combined. While not as salable as oak other hardwoods such as beech, birch, hard maple, elm, and ash, together with some pine, tamarack and cedar are also marketable.

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*Diameter of standing trees is taken at a point about 4½ feet from the ground.

Trees to be used for ties must be reasonably straight, sound and free from decay and large knots. Standing trees less than 13 or 14 inches at the butt probably will not yield acceptable tie cuts. The minimum length of ties is 8 feet, but most railroads demand 8½ or even 9-foot lengths.

When tie cuts are to be sold, the farmer should recognize that a cut which is 16 inches in diameter at the small end will, if sound and straight, yield two average sized ties. In other words, market large trees as saw or veneer logs, or else make sure of getting the top price when selling good timber for ties.

D. Pulpwood:

Pine, hemlock, spruce, balsam fir, and aspen (popple) are the Wisconsin woods most commonly sought by pulp and paper mills. The wood is usually cut in 100-inch lengths and is sold by the cord -- a stack of 100-inch sticks, 4 feet high and 4 feet wide.

Some buyers require peeled sticks while others accept wood with the bark on. Most any sized, sound material is acceptable in sizes as low as 4 inches in diameter inside the bark. Because the pulpwood market is a good outlet for small sized material, farmers have an opportunity to sell small trees which are removed from the woods in thinning, as well as to utilize the tops of larger trees that have been cut for saw logs.

E. Piling and Poles:

Oak, pine, tamarack, and cedar are the Wisconsin species most used for piling, but other than for local use, cedar is the only tree that is in demand for telephone or telegraph poles. Local and temporary uses may permit acceptance of any kind of tree provided it is sound, straight, and has a gradual taper from butt to tip. Except for local use, however, the market for piling and poles in the state is quite irregular because most of the commercial poles and much of the piling used is shipped in from the western and southern states.

Piling and poles are sold either by the linear foot or by the piece. Rural telephone and light companies, together with construction projects, particularly along the large rivers and lakes, consume much native material, but the demand is not constant and hence few regular markets are established. Prices for cedar poles range from 50 cents to $2.50 per pole. Piling prices may vary between 12 and 20 cents per foot, depending on the species, quality of the material, and the nearness to the market.

F. Bolts for Boxes, Excelsior, Handles, Bowling Pins, and Staves:

There are many manufacturers in the state who buy short lengths of logs for special purposes. When such markets are available nearby, farmers can find an outlet for material too short to be cut into saw logs, and frequently because of special requirements, such as for bowling pins, the price is much better than could be obtained from the same material if sold for some other use.

G. Fuelwood:

Hard maple, oak, hickory, beech, birch and ash are the best Wisconsin woods for fuel, simply because these give more heat per cord than do the softer, lighter species. What many wood users overlook, however, is the effect that drying has on the fuel value of the wood they burn; green wood has only about 65% of the total available heat that dry wood has, hence seasoned wood should be worth one-third more than green wood. Thorough seasoning requires at least six months and preferably a year.

Most fuelwood is used on the farm where cut, or nearby. This wood is cut 12-18" long and later split into fuel for heating stoves or furnaces and cooking stoves. However, farmers have made good wages in the winter, or during slack times, by clearing up for fuelwood the tops left from logging or tie operations. Some also recognize that a good wood market makes it possible to use some of the poorly formed or diseased trees and thus make room in their woods for better and more thrifty trees.

The fuelwood market uses three types of measurements. In most universal use is the standard 4' x 4' x 8' cord. Local sales sometimes use 16" cords or blockwood which is equivalent to about 1/3 of a standard. Occasionally fuelwood is sold by weight.

Markets for the standard 4' x 4' x 8' cord of fuelwood specify that round sticks over 5" in diameter or an 8" face be split. Split sticks of bodywood are more desirable than limbwood.

The fact that fuelwood prices range from $4 to $8 per cord (4' x 4' x 8') delivered on the farm or nearby, indicates that it is a low-value product. But it must be remembered that wood used for fuel generally cannot be used for other purposes, and at top prices farmers can make money even when shipping to considerable distances. It may pay farmers, therefore, to investigate current market prices.

H. Fence Posts:

Like fuelwood, most of the wood fence posts used in Wisconsin are cut from the nearby farm woods, although many farmers in the southern part of the state are now compelled to purchase posts that have been shipped in from considerable distances. White and red cedar are the best native trees for posts. Split white and burr oak, as well as some other species are sold locally, but generally untreated wood posts other than cedar do not have a state-wide market. Round cedar line posts should be at least 4 inches in diameter at the small end and 6 to 6½ feet long; split posts should be at least 3 inches measured along their smallest dimension. Oak posts should be at least 1" larger in diameter. Corner posts should not be less than 6 inches across and 7½ feet long.

Prices for average grade, white and red cedar line posts range from 10 to 25 cents each, f.o.b. location where cut.

I. Maple sirup:

1. Where hard or sugar maple grows in considerable quantities, there is a possibility of adding to the farm income by utilizing the sap

of this tree. (Soft maple also yields satisfactory sap, but it does not ordinarily produce large enough quantities to make a worthwhile operation.) Although the evaporating and other equipment necessary for such an enterprise represents an additional investment over the usual farm equipment, a recent study of 130 maple groves in Maryland showed an annual net profit per acre varying from $0.45 to $9.50.

2. It is not economical to tap trees less than 10" in diameter; large, full-crowned, thrifty trees are the best producers. Production, however, depends to a large extent on the climatic conditions in the locality. Cool nights, warm days in the spring, moist but well-drained sites and heavy snowfall during the months preceding the tapping are conducive to highest yields. Best yields come from ungrazed woods. Unless sap could be pooled and evaporated at a central point, an operation involving less than 200 trees probably would not be economical. From 30-60 gallons of sap will produce one gallon of sirup.

3. The product is sold mostly as sirup, although a very small amount of sugar is manufactured but is generally consumed locally, (one gallon of sirup equals eight pounds of sugar. Eleven pounds per Standard U. S. gallon is the standard for the four grades under which sirup usually is sold; all except the lowest grade must be free from any trace of fermentation, sappiness, or cloudiness. The lighter the color the higher the grade.

J. Christmas Trees

1. On many sites Christmas tree plantations may make a relatively high return with little or no care. Experience indicates, however, that, as with any specialized crop, the best practice is to establish the plantation on good tillable land, applying special practices such as cultivation, pruning and marketing to bring high returns. Douglas fir, white spruce, Norway spruce, balsam, or even red pine and red cedar are the species best adapted for this purpose, although the spruces, pines and cedar may not be so easily marketed in localities where they have to compete with the balsam and fir shipped in. The big advantage of locally grown trees is the fact that needles from freshly cut stock will not shed during the holiday period, and people will visit the local plantation to select and cut their own tree.

2. Trees are acceptable from 2 to 10 feet in height, the most popular being those about 5 to 6 feet. Symmetrical specimens, with full foliage from the lower branches to the top, are desirable. Conversely, trees with long, terminal shoots and few needles or trees that have been exposed to hot sun with the resulting dying back of branches on one side of the trees are not so readily marketable.

References: Wis. Sp. Cir. - "Marketing and Harvesting Farm Timber" - Sept., 1942
USDA Farm. Bull. 1907 - "Equipment and Methods for Harvesting Farm Woodland Products"

SELECTION OF LUMBER FOR FARM AND HOME BUILDING PURPOSES

Building Uses	Species
Floors	Oak, ash, beech, birch, hard maple, elm
Framing (Buildings)	Hemlock, pines, spruces. (Also those listed under "Floors")
Interior Trim (House)	Ash, birch, hard maple, oak, cedar, beech, pines, spruce, basswood.
Lath (House)	Jack pine, white pine, spruce, hemlock
Roof Boards	All pines, hemlock, cedar, aspen, soft maple
Shingles	Cedar, white pine, jack pine
Sub-floors	All species
Shelving	All species (except hemlock).
Siding	Cedar, white pine, yellow poplar, spruce
Sheathing	All species
Mangers (Barns)	Ash, beech, birch, hard maple, elm, hickory, oak.
Sills on Foundation Walls (Barn)	Cedar, white oak, elm, yellow poplar. (Give good preservative treatment.)
Concrete Forms	White pine, spruce, hemlock, basswood, beech, birch, cottonwood, maple, oak. (In order named.)
Gates & Fences (Exclusive of posts)	White oak, cedar, white pine, elm.
Posts	Osage-Orange, cedar, tamarack, white oak, black locust, all other species (when given thorough preservative treatment.)
Scaffolding	White ash, birch, elm, maple, oak.
Silos, Tanks and Vats	Cedar, white oak (heartwood).
Well platforms	Cedar, white oak (heartwood), tamarack, elm.
Handles, Implements, etc.	Ash, hickory, elm, ironwood.

All farm timbers used in contact with the ground should be of durable woods such as white oak or black locust or of "sap" woods treated with creosote.

MEASUREMENT OF STANDING TIMBER

A. Before intelligent management can be applied to any type of land, property, or business, an inventory of the physical conditions, products, or assets should be available. In the farm woods an essential part of such an inventory is an estimate of the amount of timber on the land and the annual rate of growth.

B. The inventory is expressed in terms of board feet, cubic feet, cords, or pieces of some specific product per acre. A breakdown of numbers of trees into diameter classes may be desirable.

C. Any timber inventory is at best an estimate. The lack of uniformity of trees, species and growing conditions in different parts of the woods makes it impossible to get an exact figure, particularly since the unit of measurement itself is usually in terms of a product which requires processing before its exact volume is known.

D. The best that can be done is to measure all the trees in the woodland, but the necessary time involved makes such a procedure impractical. For this reason, the inventory or cruise, is made by measuring the trees standing on a number of mechanically selected sample areas, such as one-quarter or one-fifth acre plots, reducing the total inventory shown by these plots to an acre basis and then applying the result to the total acreage in the woodland.

E. For even a fair degree of accuracy, 10 per cent of the woods should be sampled; in areas under 20 acres, particularly where there is an uneven distribution of tree sizes, 20 to 50 per cent is not too intensive for reasonable results.

F. To eliminate personal bias in selecting the plots, the best plan is to work back and forth systematically in cardinal directions through the woods. At fixed intervals -- say every 200 feet -- stop measure, and record the diameters and merchantable heights on a known part of an acre. One man writes down the tree sizes as called out by a second, who does the measuring. When finished they move, perhaps on a compass line, and by pacing establish the center of the next plot where the operation is repeated.

G. The Federal Land Bank cruiser stick is a very handy tool for measuring heights and diameters. The cumulative volume tally form which follows has been designed for a fifth acre plot (radius 52.7 ft.) and is a handy tool for tallying volumes.

CUMULATIVE VOLUME TALLY

INSTRUCTIONS ON REVERSE SIDE

NAME _____ TYPE _____ PLOT NO. _____ SEC. _____ TWP. _____ COUNTY _____

VOLUME IN TENTHS OF CORDS

NUMBER OF 8-FOOT BOLTS PER TREE

DBH	1	2	3	4	5	6	7	TOTALS
6	1 2 2 3 4 5 6 6 7 8 9 10 10 11 12 13 14 14 15 16 17 18 18 19 20 21 22 22 23 24 25 26 26 27 28 29 30 30 31 32 33 34 34 35	1 3 4 6 7 9 10 12 13 14 16 17 19 20 22 23 25 26 28 29 30 32 33 35 36 38 39 41 42 44 45 46 48 49 51 52 54 55 57	2 4 7 9 11 13 15 18 20 22 24 26 29 31 33 35 37 40 42 44 46 48 51 53 55 57	3 6 9 12 14 17 20 23 26 29 32 35 38 41 44 46 49	LEGEND			
8	1 3 4 6 7 9 10 12 13 14 16 17 19 20 22 23 25 26 28 29 30 32 33 35 36 38 39 41 42 44 45 46 48 49 51 52 54 55 57 58 59 61	2 5 8 10 12 15 18 20 22 25 28 30 32 35 38 40 42 45 48 50 52 55 58 60 62 65 68 70 72 75 78 80 82 85 88 90 92	3 7 10 13 16 20 23 26 30 33 36 40 43 46 50 53 56 59 63 66 69 73 76 79 82 86 89 92 96 99 102	4 8 13 17 21 25 29 34 38 42 46 50 55 59 63 67 71 76 80 84 88 92 97 101 105 109	5 11 16 22 27 32 39 43 49			
10	2 5 7 9 12 14 16 18 21 23 25 28 30 32 34 37 39 41 44 46 48 51 53 55 58 60 62 64 67 69 71 74 76 78	4 8 12 16 20 24 28 32 36 40 44 48 52 56 60 64 68 72 76 80 84 88 92 96 100 104 108 112	5 10 15 20 26 31 36 41 46 51 56 61 66 71 76 82 87 92 97 102 107 112 117 122	6 12 19 25 31 37 43 50 56 62 68 74 81 87 93 99 105 112 118 124	8 16 24 10 20 30 32 40 48 39 49 59 56 64 72 69 79 89 80 88 96 98 108 118			
12	3 6 10 13 16 20 23 26 29 32 36 39 42 46 49 52 55 58 62 65 68 72 75 78 81	6 11 17 23 29 34 40 46 52 58 63 69 75 80 86 92 98 104 109 115 121	7 14 21 29 36 43 50 57 64 72 79 86 93 100 107 114 122 129	9 17 26 35 43 52 61 69 78 86 95 104 112 121 130	11 21 32 42 53 63 74 84 95	13 27 40 53 66 80 93 106 120	17 33 50 66 83 99 116 132	CORDS/ACRE

VOLUME IN HUNDREDS OF BOARD FEET (INTERNATIONAL)

NUMBER OF 16-FOOT LOGS PER TREE

NON-MERCH. DBH	½	1	1½	2	2½	3	4	TOTALS
10	1 2 3 3 4 5 6 7 8 8 9 10 11 12 13 14 14	2 4 6 8 10 12 14 16 18 20 21 23 25 27 29 31 33 35 37 39 41 43 45	3 5 8 11 13 16 19 21 24 26 29 32 34 37 40 42 45 48 50 53	3 7 10 14 17 20 24 27 31 34 37	CULL %_____ DATE_____ ESTIMATOR_____			
12	2 3 4 6 8 9 10 12 14 15 16 18 20 21 22 24 26	3 6 9 11 14 17 20 23 26 28 31 34 37 40 43 46 48 51 54 57 60 63 66	4 8 12 16 20 24 28 32 36 40 44 48 52 56 60 64 68 72 76 80 84	5 10 15 20 25 30 35 40 45 50 55				
14	2 4 6 8 10 13 15 17 19 21 23 25 27 29 32 34	4 8 12 16 20 24 28 32 36 40 43 47 51 55 59 63 67 71 75 79 83 87	6 11 16 22 28 33 38 44 50 55 60 66 72 77 82 88 94 99 104 110	7 14 21 28 35 42 49 56 63 70 77 84 91 98 105 112	8 16 24 33 41 49 57 65 73 82 90 98			
16	3 6 9 12 15 18 21 24 27 30 32	5 10 16 21 26 32 37 42 47 52 58 63 68 74 79 84	7 15 22 29 37 44 51 59 66 74 81 88 96 103	9 18 27 36 45 54 63 72 81 90 99	11 21 32 43 53 64 75 85	12 25 37 49 62 74 86 99		
18	4 7 11 15 18 22 26 30 33 37 41	7 14 20 27 34 40 47 54 61 68 74 81 88 94 101	9 19 28 38 47 56 66 75 85 94 103 113 122	12 24 35 47 59 70 82 94 106 118 129	14 28 42 56 70 83 97 111	16 32 48 64 80 96 112 128	20 40 60 80 100	
20	5 9 14 18 23 28 32 37 41 46	8 17 26 34 42 51 60 68 76 85 94 102 110 119 128	12 24 35 47 59 71 83 94 106 118 130 142 153	15 30 44 59 74 88 103 118 133 148 162	18 35 52 70 88 105 122 140	20 40 60 80 100 121 141	25 50 75 100 125	
22	6 11 17 22 28	10 21 31 42 52 63 73	14 29 44 58 72 87 102	18 36 54 72 90 109	22 43 64 86	25 49 74 99	31 61 92	
24	7 13 20 27 33	13 25 38 50 63 76 88	17 35 52 69 86 104 121	22 43 65 86 108 129	26 51 77 102	30 59 89 119	37 74 111	
26	8 16 24 32 40	15 30 45 60 75 90 105	20 41 61 82 102 123 143	25 51 76 102 127 152	30 60 91 121	35 70 106 140	44 88	
28	9 19 28 37 47	17 35 52 70 87 104 122	24 48 72 96 120 143	30 60 90 119 149	35 70 106 141	41 81 122 162	51 103	
30	11 22 33 44 55	20 41 61 82 102 122 143	28 55 83 110 138 166	34 69 103 137 172	41 81 122 162	47 93 140 187	59 118	
35	16 31 47 62 78	28 57 85 113 142 170	39 77 116 155 193 232	48 95 143 191 238	56 112 169 225	65 129 194 259	81 163	BD.FT./ACRE
40	21 42 62 83 104	37 74 112 149 186 223	50 101 151 201 252 302	62 125 187 249 312	74 148 221 295	85 170 255 341	108 216	

OPERATION RECOMMENDED:

HARVESTING WOODLAND PRODUCTS

1. Volume cut of merch. sawlogs should never exceed accumulated annual growth.

Suggested Guide:

Stand under 4000 Bd.Ft. per Acre in trees 10" D.B.H. & over.	Cut only very defective stems.
" 4000-6000 " " " " " " " " " "	Cut not more than 2% net volume annually.
" 6000-10000 " " " " " " " " " "	Cut not more than 3% net volume annually.
" over 10000 " " " " " " " " " "	Cut not more than 4% net volume annually.

2. Plan utilization in accordance with the size, form, condition and species of trees to be cut.

3. If product is to be sold, specifications of products should be known when trees are harvested so logs can be properly cut.

MARKETING WOODLAND PRODUCTS

1. It is to the owner's advantage to sell products not stumpage. The total value of timber products laid down at the point of utilization is approximately made up as follows:

Stumpage (value of standing timber)	13 percent
Cutting (felling, bucking, splitting, peeling)	40 "
Skidding and decking	12 "
Hauling, loading and unloading	35 "

2. The market should be located and an agreement made on its disposal, before timber is cut. Investigate responsibility of buyer and obtain a written sales agreement.

INSTRUCTIONS-
THE FIGURES ON THIS VOLUME TALLY ARE COMPUTED FOR A 1/5 ACRE PLOT (RADIUS-52.7 FEET). THE FIGURES ARE CUMULATIVE IN EACH BLOCK - THE FIRST NUMBER REPRESENTING THE VOLUME OF ONE TREE, THE SECOND NUMBER THE VOLUME OF TWO TREES, ETC.
TALLY TREES IN EACH "DBH-MERCHANTABLE HEIGHT" BLOCK BY CROSSING OUT NUMBERS IN CONSECUTIVE ORDER, BEGINNING FROM THE FIRST NUMBER IN THE BLOCK. THE LAST NUMBER CROSSED OUT IN EACH BLOCK INDICATES THE COMBINED VOLUME OF ALL TREES IN THAT "DBH-MERCHANTABLE HEIGHT" CLASS. FOR EACH DBH CLASS ADD THE VOLUME IN ALL BLOCKS, AND ENTER THIS SUM AS A SUB-TOTAL IN THE "TOTAL" COLUMN. TOTAL MERCHANTABLE VOLUME EQUALS SUM OF THESE SUB-TOTALS.
CORDWOOD TALLY- NUMBERS IN BLOCKS REPRESENT TENTHS OF STANDARD CORDS (UNPEELED). THEY ARE ALREADY MULTIPLIED BY 5, THUS GIVING VOLUME PER ACRE DIRECTLY FROM A 1/5 ACRE PLOT.
SAWTIMBER TALLY- NUMBERS IN BLOCKS REPRESENT HUNDREDS OF BOARD FEET (INTERNATIONAL 1/4" RULE). THEY ARE ALREADY MULTIPLIED BY 5, THUS GIVING VOLUME PER ACRE DIRECTLY FROM A 1/5 ACRE PLOT.
LEGEND- DIFFERENT SPECIES OR SPECIES GROUPS ARE DISTINGUISHED BY USING DIFFERENT SYMBOLS OR COLORS IN CROSSING OUT NUMBERS IN EACH BLOCK. ROOM IS RESERVED IN THE "LEGEND" BOX TO RECORD THE SYMBOL OR COLOR USED FOR EACH SPECIES.

LAKE STATES FOREST EXPERIMENT STATION
ST. PAUL MINNESOTA
1942

ESTIMATING PRODUCTS IN STANDING TREES

Board Feet

Veneer logs, saw logs, and bolts cut for many special purposes are measured by the board foot, which is simply a piece of wood 12" x 12" x 1" in thickness. After measuring the diameter of the tree and determining how far up the trunk it is merchantable, the following tables will give the approximate contents in board feet. In other words, the tables indicate the approximate amount of lumber that can be manufactured from the tree at the sawmill. Thus an oak tree 20 inches in diameter and 30 feet to a point where it becomes too small to be cut for a saw log, will contain about 243 board feet. Notice that one of the tables is for hardwoods, and the other is for pine.

HARDWOODS
(WHITE AND RED OAKS)
Volume in Board Feet -- Scribner Scale

Diameter in Inches	Merchantable Height in Feet Above Stump					
	10	20	25	30	40	50
12	30	52	61	70	82	95
14	43	74	86	100	118	139
16	59	101	119	138	170	205
18	76	137	160	187	239	276
20	96	175	205	243	308	360
22	--	224	260	308	385	445
24	--	275	325	375	468	550

PINE (BASED ON WHITE PINE)
Volume in Board Feet -- Scribner Scale

Diameter in Inches	Merchantable Height in Feet Above Stump						
	10	20	25	30	40	50	60
10	14	29	35	40	48	57	61
12	25	46	54	62	73	85	94
14	40	69	81	92	108	129	143
16	55	98	116	132	160	186	208
18	--	127	156	175	222	263	285
20	--	163	192	224	284	337	367
22	--	208	246	287	360	420	465
24	--	255	305	350	443	510	570

The above tables assume that the entire trunk can be made into sound lumber which is not always the case. Deductions are made in the final scale for any defect, such as rot, seams, shake or crook, hence the final volume is usually somewhat lower than the original estimates.

Cord.

Fuelwood, pulpwood and excelsior wood are sold by the cord, which is a stack of four foot wood, piled four feet high and eight feet long. The standard cord, therefore, is 4' x 4' x 8', hence a 4' x 8' rick of stovewood or blockwood which is cut in 16" lengths actually contains but one-third of a standard cord. A cord of pulpwood cut in 100" lengths will measure 4' high and 4' long.

Fuelwood taken from the tops of trees which have been cut for saw logs or ties cannot be estimated with any degree of accuracy. Roughly, there are about 1 to 1½ cords of fuelwood in tops for every 1,000 board feet of saw logs cut, and about one cord for every 10 ties.

The following table will give approximately the total number of standard cords of fuelwood, using branches down to 2" in diameter, in hardwood trees of a given diameter and total height.

HARDWOODS
Volume in Cords - 2" in diameter
Entire Tree

Diameter in Inches	Total Height of Tree in Feet			
	40	60	80	100
10	.16	.21	.25	-
12	.25	.31	.39	-
14	.34	.43	.55	.68
16	.45	.56	.72	.90
18	.56	.70	.90	1.10
20	.68	.85	1.10	1.40
22	.82	1.00	1.30	1.70
24	.97	1.20	1.60	2.00
26	1.14	1.44	1.90	2.40
28	1.34	1.70	2.20	2.80

Piece Products

Railroad ties and fence posts are marketed by the piece. In oak or other hardwood timber the approximate number of ties that can be cut from straight sound trunks can be obtained fairly accurately by using the table below. Simply determine the diameter of the tree and then by measuring the height determine whether 1, 2, or 3 tie cuts can be made from the trunk.

NUMBER OF TIES PER TREE

Diameter in Inches	1 cut - 9'		2 cuts - 18'		3 cuts - 27'	
	Number	Grade	Number	Grade	Number	Grade
12	1	3	2	2	3	2
13	1	4	2	3	3	3
14	1	5	2	4	3	4
15	1	5	2	5	3	4
16	1	5	2	5	3	5
17	2	3	3	4	4	4
18	2	3	3	4	4	4
19	2	4	4	3	4	4
20	2	5	4	3	5	4

Number of Sound Trees per 1000 Board Feet of Lumber

Tree Diameter Inches	Short Trees Ave. one 16' Log	Med. Ht. Trees Ave. two 16' Logs	Tall Trees Ave. 2½ 16' Logs
14	16	10	8
16	12	8	6
18	9	6	4
20	8	5	3
22	6	4	2½

SELECTING, SEASONING & USING HOME-GROWN LUMBER

A. Logging for Home Construction

The proper use of home grown timbers in farm buildings begins with logging. The most important factors that affect later use of the sawed products are: Time of year for cutting logs, log lengths, and care of the logs before sawing to prevent checking.

Logs may be cut at any time of year, but in order to take fullest advantage of favorable seasoning weather immediately after lumber is sawed, assuming the logs will be sawed soon after cutting, late winter or early spring is recommended.

Lumber lengths for home buildings may be easily determined after the building plans have been agreed upon. Log lengths should be such that the resulting lumber will well fit the bill of material. Some extra allowance in length should always be made for trimming the finished lumber to proper length. Generally three to four inches is sufficient.

Logs exposed to sunshine for extended periods between cutting and sawing will usually show pronounced cracks or checks in the end surfaces, especially with hardwoods. If prompt sawing is not possible, the logs should be rolled into decks on pole stringers and the ends of the logs should be coated with linseed oil or melted paraffin. Deep end checks may cause serious lumber losses after the logs are sawed.

B. Making the Lumber

For small jobs, logs probably will be hauled to a mill. On large jobs, a portable mill often may be secured to move to the logs. Uniform width and thickness of all lumber should be insisted upon and can be produced by a competent sawer with good equipment. Wedge shaped, irregularly sawed and undersized lumber, which is frequently produced, results in loss of material and labor due to excessive trimming to obtain uniform dimensions.

All lumber shrinks after seasoning. It is important to allow for this shrinkage when thickness and width are determined. If, in addition, it is planned to dress and match the lumber later, then some allowance must be made for wood to be removed by the plane, as follows:

B. Making the Lumber (Cont.)

1. Insist on full one inch or two inches of thickness when standard 13/16 inch or 1-13/16 inch products are desired.

2. Insist on full 6", 8" or 10" widths when standard 5-5/8", 7-5/8" or 9-5/8" widths in products are desired.

C. How to Sort and Pile Green Lumber for Seasoning

Piling all lumber flatwise for drying is done almost universally. With this method the drying rate is relatively slow and the weight of the pile tends to keep the stock from warping. It is, therefore, recommended.

The important elements in good lumber piling are:

1. Location full exposed to the wind

2. A firm foundation, with piling blocks sufficiently high to provide free circulation of air under the pile

3. A downward slope of one inch per foot of length of foundation from front to rear

4. Stickers between layers three feet, or not over four feet, apart and directly above cross frames

5. Front sticker flush or 1/2" beyond front end of lumber

6. Lumber to have full inch space between each board in a layer

7. Pile like lumber (same thickness and width) together

8. Provide a roof of slabs or of old lumber for each pile

9. Maintain flues or openings between boards for entire height.

Reference: Wis. Sp. Sten. Cir. - "Selecting, Seasoning & Using Home Grown Lumber" - June, 1942

SCRIBNER DECIMAL C LOG RULE

Diameter	Length - Feet										Diameter
	6	8	10	12	14	16	18	20	22	24	
	Contents - Board Feet										
Inches											Inches
6	5	5	10	10	10	20	20	20	30	30	6
7	5	10	10	20	20	30	30	30	40	40	7
8	10	10	20	20	20	30	30	30	40	40	8
9	10	20	30	30	30	40	40	40	50	60	9
10	20	30	30	30	40	60	60	70	80	90	10
11	20	30	40	40	50	70	80	80	90	100	11
12	30	40	50	60	70	80	90	100	110	120	12
13	40	50	60	70	80	100	110	120	130	150	13
14	40	60	70	90	100	110	130	140	160	170	14
15	50	70	90	110	120	140	160	180	200	210	15
16	60	80	100	120	140	160	180	200	220	240	16
17	70	90	120	140	160	180	210	230	250	280	17
18	80	110	130	160	190	210	240	270	290	320	18
19	90	120	150	180	210	240	270	300	330	360	19
20	110	140	170	210	240	280	310	350	380	420	20
21	120	150	190	230	270	300	340	380	420	460	21
22	130	170	210	250	290	330	380	420	460	500	22
23	140	190	230	280	330	380	420	470	520	570	23
24	150	210	250	300	350	400	450	500	550	610	24
25	170	230	290	340	400	460	520	570	630	690	25
26	190	250	310	370	440	500	560	620	690	750	26
27	210	270	340	410	480	550	620	680	750	820	27
28	220	290	360	440	510	580	650	730	800	870	28
29	230	310	380	460	530	610	680	760	840	910	29
30	250	330	410	490	570	660	740	820	900	990	30

SHELTERBELTS FOR WINDBLOWN SOILS

1. Shelterbelts -- tree belts along fields to prevent wind erosion -- should be placed wherever there is blowing or drifting of surface soil. The shelterbelt should preferably be planted at right angles to the prevailing direction of the wind. For many farms, tree belts in a north-south direction will give the necessary protection. Sometimes L-shaped shelterbelts, across the north and west sides of a field, are necessary to reduce effectively wind erosion losses.

2. There is a growing need for pine shelterbelts to replace open, oak hedge rows or strips. The oak is gradually thinning out and, at best, never provided fully effective field shelters. When pines replace oak and other hardwoods in such rows or belts, there will be a noticeable difference in the appearance of field crops growing near to the belts. Hardwood roots "sap" the soil for a considerable distance from the trees. Pines do not.

3. The shelterbelt may be along the line fence but often there will be one or more additional belts within the boundaries of the farm. By jacketing the trunks or stems of the trees growing along the property lines, it is possible to string wires to the jackets, and thereby have in effect living fence posts. One-inch boards may be used for making the jackets.

4. In areas of very severe wind erosion, shelterbelts might well be 40 rods apart. The greatest possible width of protected area from a shelterbelt is not more than twenty times the height of the tree belt. Tree belts 40 feet high, spaced 40 rods apart, would effectively stop all sand storms.

Type of Soil Determines Kind of Tree

Shelberbelts should be limited to the species of pine adapted to Wisconsin climate. On farm soils that are sandy and subject to wind erosion, jack pine, Scotch pine and Norway pine are the most suitable trees. Many farmers prefer at least one row of white pine in a shelterbelt. This tree requires at least a sandy loam quality, and often it is difficult to get good white pine even on sandy loam, because white pine needs, also, some shade for the first few years after planting.

Fall Preparation of Soil Best

It is always better to prepare the soil in the fall rather than in the spring. Frequently, however, the delayed harvest of a crop or a change in cropping plans causes a delay until spring.

The complete plowing of the shelterbelt strip is generally recommended as a fall practice. Where there is heavy sod, a wide shallow furrow should be plowed for each row that is to be planted. The plowed strip should be 18 feet wide for the standard three-row shelterbelt, while an 8-foot strip is sufficient for a two-row shelterbelt.

When planting time arrives in the spring, the rows should be marked off with a potato-row or other suitable marker. The trees are planted directly in the fall-plowed soil.

Tree Combinations and Spacing

The tallest possible shelterbelt can be obtained only when at least one row of trees is subject to shading from the side. A single row, or even two rows, of trees will develop dense side limbs, but will not stimulate height growth. The center row of a three-row shelterbelt will respond to competition from the side by sending up taller annual leaders. It is for this reason that wherever possible, a shelterbelt should consist of three rows.

Either jack pine or Norway pine should be in the center row because they respond well to crowding from the side and have the capacity to reach considerable height when growing under crowded conditions. Scotch pine is well suited for both the windward and leeward rows of the shelterbelt.

If white pine is used at all in open planting, mixed with other species of pines, it should be in the windward row; that is, the row facing the prevailing winds, usually the north or west row. Shelterbelts collect deep snow drifts within them. White pine on the leeward side of a shelterbelt has been severely damaged from melting snowdrifts. The small, tender limbs are readily stripped from the stems in heavy drifts, and frequently the leaders are broken, thus badly deforming the tree.

Rows should be 8 feet apart, and the trees should be 6 feet apart in the rows, spaced alternately.

When Planting Shelterbelt Trees

A V-shaped hole, with one vertical wall, is the most suitable type of planting hole. It can be made most quickly and easily by inserting the blade of a gravel shovel for its full length in a vertical position, prying forward and backward a few short strokes, in order to form a firm wall. Then remove the shovel blade, insert it at a 60 degree angle some 6 or 8 inches from the first opening, and in such a manner as to be able to lift a wedge-shaped piece of soil from the hole.

Caring for the Young Shelterbelt

Like any other plants, young trees do their best if they are cultivated. The type of cultivation best suited to the trees is determined by whether the trees are planted in fall-plowed soil, or in furrows. Cultivation should start within one month from the date of planting. An ordinary sulky cultivator gives good results on fall-plowed shelterbelt strips.

Where furrow planting has been done on soil not covered by sod, a very efficient job of cultivating can be done by attaching two discs to a sulky cultivator in place of the shoes, working next to the row of trees. The discs should be set to throw the soil away from the trees. After the second cultivation with the use of the two discs, the standard shoes of a sulky or a single-row cultivator will work the soil sufficiently.

It is well to cultivate at least three times a year for the first two years after planting, and twice a year thereafter, until the trees are too large to cultivate with a sulky-type cultivator. Cultivation need not be done after the first of August.

Reference: Wis. Cir. 287 - "Shelterbelts for Windblown Soils" - Rev. Jan., 1941

THE FARM WINDBREAK

A well-planned, carefully planted, and properly managed windbreak can be an asset on any Wisconsin farm. Our most severe winter storms are driven, most generally, by north and north-west winds. Such winds also are accompanied by lower temperatures. To break the force of these winds, then, and to reduce the plowing and drifting of snow, the windbreak should, preferably, be partly to the north, and partly to the west of the farmstead. An L-shaped windbreak offers the most protection.

It is important, too, to locate the windbreak near enough, and yet not too distant from the buildings to be protected.

To grow a windbreak successfully

1. Choose the best location
2. Prepare the soil properly
3. Choose the right trees
4. Space the trees most effectively
5. Give the young trees the most helpful conditions for growth.

How Near the Buildings?

On the leeward or protected side of a windbreak, for a distance of 10 to 30 feet, there is a zone of calm where large drifts of snow accumulate during wind-driven snow storms. For this reason, the windbreak should be at least 50 feet, and preferably 100 feet away from the principal area or buildings to be protected.

The length of the windbreak will be determined by the area occupied by the buildings. It should extend at least 50 feet beyond the last building or feed lot area to be protected.

It Pays to Prepare the Soil

Windbreak trees should never be planted in sod, or in loose, recently plowed garden or field soil. Heavy soils, and soils covered with sod should be plowed in late summer or early fall. Sod turned over in late summer will be sufficiently rotted by spring to be easily torn up by discing before planting. If the soil where the trees are to be planted has been deeply plowed, and is relatively loose, it should be packed by rolling or cultipacking.

Light or sandy soils which are plowed or disced in the fall should be covered with some organic material such as well rotted manure, during the winter months. This will increase the fertility of the soil, which is always desirable to hasten tree growth, and it will also reduce soil and soil moisture losses caused by blowing and drifting of the surface soil during the winter and early spring months.

The choice and size of trees for the windbreak will depend on type of

soil, general region of the state, cost of the trees, and the primary purpose of protection.

Conifers Are Preferred

The most suitable windbreak trees are white spruce, blue spruce, Black Hills spruce, Norway spruce, Douglas fir, white pine, Norway pine, Austrian pine and arbor vitae (white cedar).* These it will be observed, are all conifers, or as they are frequently called, evergreens.

Conifers should be at least three years old, once transplanted in the nursery; and 4-year or even 5-year old transplants are recommended with such trees as the spruces and Douglas fir. Smaller seedlings or transplants may be safely used, but more cultivation will be necessary for several years until the trees have grown beyond the danger of severe weed and grass competition.

Suitable windbreak trees may be grouped according to the kinds of soil to which they are adapted:

Light sandy soils:

- Norway pine
- Scotch pine

Light loam soils:

- Douglas fir
- White pine
- Norway spruce

Heavy loams and clay:

- White spruce
- Arbor vitae (white cedar)
- Blue spruce
- Black Hills spruce
- Austrian pine (principally in southern Wisconsin)

Where a windbreak is needed simply as a snow trap around a feed lot, a closely spaced row of Russian willow, white ash, cottonwood, white cedar or jack pine will serve the purpose. A high shrub such as Siberian pea or lilac will do equally as well.

Three Rows of Trees Needed

Using two or more species of trees in a windbreak has two advantages: A more compact growth of foliage may be obtained especially where spruce or arbor vitae are used with the open-growing white or Norway pines; and the possible loss of one species from a future insect or disease epidemic will not destroy the windbreak. The faster growing Russian willow or the cottonwood may be used to give early protection while the slower conifers are becoming established on the leeward side of them.

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*All of these kinds of trees may be secured from nurseries in this and adjoining states. A few of these species may be obtained as transplants from the state forest nursery to be used in special windbreak demonstrations, conducted under the direction of the county agricultural agent. The species generally available at the state nursery are white spruce, Norway spruce, white pine, and Norway pine.

Three rows of trees are recommended. For all species of trees suitable for a windbreak, except white cedar, the rows should be eight feet apart and the trees six feet apart in the rows. For white cedar the rows should be six feet apart, and the cedar trees three feet apart in the rows.

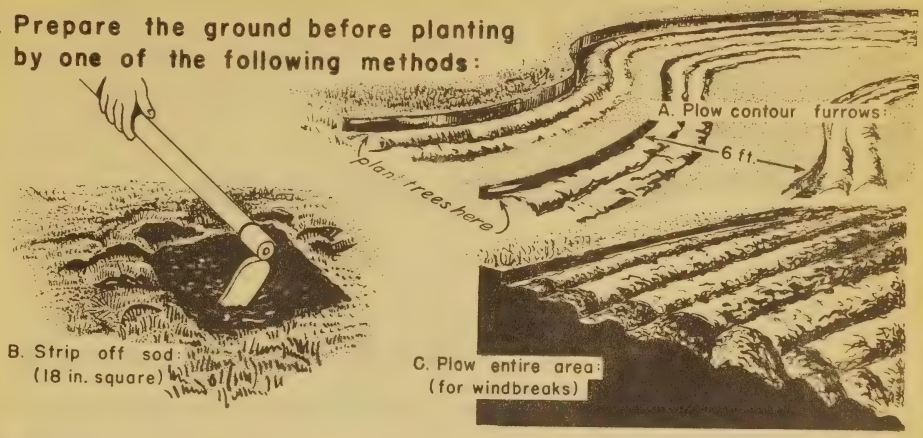
On very light, sandy soils, where growth will generally be slow, the trees should be staggered in the rows instead of being planted opposite each other, as in check rows. On the more fertile soils, however, the trees should be planted in check rows, because in 12 to 15 years they will be too crowded at a spacing of 6 by 8 feet. By removing every other tree in each row when the windbreak is 12 to 15 years of age, a staggered or alternate spacing will be obtained, and the trees will then have a 10 foot by 12 foot spacing. This insures a very compact growth of trees throughout the life of the windbreak. Where white cedar is used, however, the original spacing of three feet by six feet should be maintained, and thinning out will be unnecessary.

Reference: Wis. Cir. 267 - "The Farm Windbreak" - Rev. March, 1941

PLANTING GUIDE

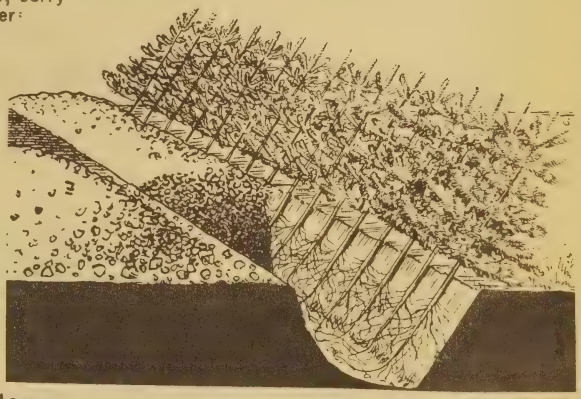
FOR TREES AND SHRUBS

I. Prepare the ground before planting by one of the following methods:



II. Unpack trees immediately and cover their roots in a trench:

A. Dig trench in shady place.
B. Keep roots wet.
C. When ready to plant, carry trees in pail of water:



III. Set trees as shown below:

A. Dig large hole

B. Set just deep enough to cover roots

C. Pack soil firmly

D. Press soil with foot

SECTION XI - PRICES, YIELDS & PRODUCTION

CROP YIELDS AND PRODUCTION

During the past two years, yields of individual crops have, in the main, materially increased. Hence, the acreage yield and production tables on the following pages reveal what production can be attained under war conditions. These figures may be compared with 10-year averages from 1932 to 1941 for past production.

Because of the tremendous need for war crops and products, acreages and shifts in crops have been made accordingly. Many more shifts will be made as a post war adjustment. These shifts and adjustments indicate the flexibility of farm production in line with war demands and favorable prices.

In practically all cases, the yields in Wisconsin exceed the average for the United States. There is an exception in the growing of potatoes. While potatoes are grown with some degree of success in certain sections of Wisconsin, it is apparent that this state as a whole is not conducive to profitable potato production.

The introduction of new varieties of seed has largely been responsible for increased yields. The wise farmer obtains new adaptable varieties that are disease resistant and capable of materially increasing production. While much plant breeding remains to be done, farmers should not hesitate to use new strains of seeds that are recommended by the College of Agriculture.

It is quite obvious that Wisconsin is a progressive dairy state. A brief blance at page 4 reveals the great difference in production between the average cow in Wisconsin and the average for the United States. This fact should indicate the potential possibilities there are in this state to provide a definite source of good foundation stock for other areas.

The development of artificial breeding indicates still further the degree of progress made in Wisconsin compared to other states. Undoubtedly, there should be definite market for well bred dairy cattle even after hostilities cease. In fact, it is entirely possible that only owners of high and economical producing cows can meet the keen competition that is apt to exist.

CROP SUMMARY OF WISCONSIN FOR OCTOBER 1, 1943

Crop	Acreage		Production					Unit	Yield per Acre		
	1943 (Preliminary)	1942	Oct. 1, 1943 Forecast	1942	10-Year Average 1932-41	1943 as a % of 1942	1943 as a % of 10-Year Average		Indicated 1943	1942	10-Year Average 1932-41
Corn	2,528,000	2,408,000	108,704,000	103,544,000	80,312,000	105.0	135.4	Bus.	43.0	43.0	34.4
Potatoes	190,000	150,000	17,100,000	10,050,000	19,083,000	170.1	89.6	Bus.	90	67	83
Tobacco	18,200	19,200	26,855,000	29,200,000	25,927,000	92.0	103.6	Lbs.	1476	1521	1389
Oats	2,620,000	2,339,000	102,180,000	100,577,000	75,418,000	101.6	135.5	Bus.	39.0	43.0	31.3
Barley	342,000	489,000	8,892,000	15,648,000	21,174,000	56.8	42.0	Bus.	26.0	32.0	28.1
Rye	109,000	135,000	1,144,000	1,620,000	2,766,000	70.6	41.4	Bus.	10.5	12.0	11.2
Winter wheat	32,000	38,000	624,000	817,000	659,000	76.4	94.7	Bus.	19.5	21.5	16.8
Spring wheat	37,000	40,000	722,000	900,000	1,066,000	80.2	67.7	Bus.	19.5	22.5	16.0
Buckwheat	18,000	14,000	261,000	210,000	179,000	124.3	145.8	Bus.	14.5	15.0	12.5
All tame hay	3,860,000	3,852,000	7,025,000	7,513,000	5,109,000	93.5	137.5	Tons	1.82	1.95	1.48
Alfalfa hay	969,000	1,167,000	2,132,000	2,859,000	1,860,000	74.6	114.6	Tons	2.20	2.45	1.96
Clover & timothy hay	2,697,000	2,452,000	4,585,000	4,291,000	2,598,000	106.9	176.5	Tons	1.70	1.75	1.31
Other tame hay	194,000	233,000	308,000	363,000	651,000	84.8	47.3	Tons	1.59	1.56	1.24
Wild hay	85,000	100,000	106,000	125,000	258,000	84.8	41.1	Tons	1.25	1.25	1.05
Dry peas	8,000	7,000	70,000	52,000	37,000	134.6	80.5	Cwt.	8.70	7.50	7.47
Dry beans	7,000	3,000	46,000	19,000	18,000	242.1	255.6	Cwt.	6.50	6.30	4.67
Flax	12,000	9,000	132,000	108,000	73,000	122.2	180.8	Bus.	11.0	12.0	10.8
Canning peas	148,600	148,000	257,080,000	260,480,000	142,020,000	98.7	181.0	Lbs.	1730	1760	1390
Corn for canning	78,100[1]	58,900	203,100	141,400	48,100	143.6	422.2	Tons	2.6	2.4	2.2
Beets for canning	5,400[1]	4,700	39,400	33,800	16,200	116.6	243.2	Tons	7.3	7.2	6.8
Green lima beans	3,300[1]	1,800	3,140,000	2,400,000	1,500,000	130.8	209.3	Lbs.	950	1330	1110
Cabbage	14,900	11,700	110,800	103,300	119,900	107.3	92.4	Tons	7.44	8.83	7.72
Onions, commercial	1,600	1,500	256,000	300,000	202,000	85.3	126.7	Cwt.	160	200	170
Sugar beets	13,000	17,000	117,000	159,800	144,700	73.2	80.9	Tons	9.0	9.4	9.4

[1] Planted acreage

CROP SUMMARY OF THE UNITED STATES FOR OCTOBER 1, 1943

Crop	Acreage (000 omitted)		Production (000 omitted)			1943 Production as a Percent of		Unit	Yield per Acre		
	1943 (Preliminary)	1942	Oct. 1, 1943 Forecast	1942	10-Year Average 1932-41	1942	10-Year Average		Indicated 1943	1942	10-Year Average 1932-41
Corn	94,297	89,484	3,055,605	3,175,154	2,349,267	96.2	130.1	Bus.	32.4	35.5	24.9
Potatoes	3,363	2,711	469,545	371,150	363,332	126.5	129.2	Bus.	139.6	136.9	116.9
Tobacco	1,471	1,379	1,394,290	1,412,437	1,349,896	98.7	103.3	Lbs.	948	1024	878
Oats	37,944	37,899	1,148,692	1,358,730	1,018,783	84.5	112.8	Bus.	30.3	35.9	28.1
Barley	15,106	16,782	330,212	426,150	243,373	77.5	135.7	Bus.	21.9	25.4	21.4
Rye	2,875	3,837	33,314	57,341	38,589	58.1	86.3	Bus.	11.6	14.9	11.4
Winter wheat	33,859	35,666	533,857	703,253	550,181	75.9	97.0	Bus.	15.8	19.7	14.3
Durum wheat	2,035	2,109	36,251	44,660	26,992	81.2	134.3	Bus.	17.8	21.2	10.1
Spring wheat other than durum	13,939	11,689	265,708	233,414	161,240	113.8	164.8	Bus.	19.0	20.0	11.7
Buckwheat	493	378	8,464	6,687	7,029	126.6	120.4	Bus.	17.2	17.7	16.6
Flax	5,843	4,402	51,486	40,660	14,226	126.6	361.9	Bus.	8.8	9.2	7.3
Tame hay	60,489	60,211	85,872	92,245	73,277	93.1	117.2	Tons	1.4	1.5	1.3
Wild hay	12,432	12,533	11,357	13,083	9,675	86.8	117.4	Tons	.9	1.0	.8

MILK COWS AND MILK PRODUCTION ON FARMS, WISCONSIN AND UNITED STATES, 1924-41

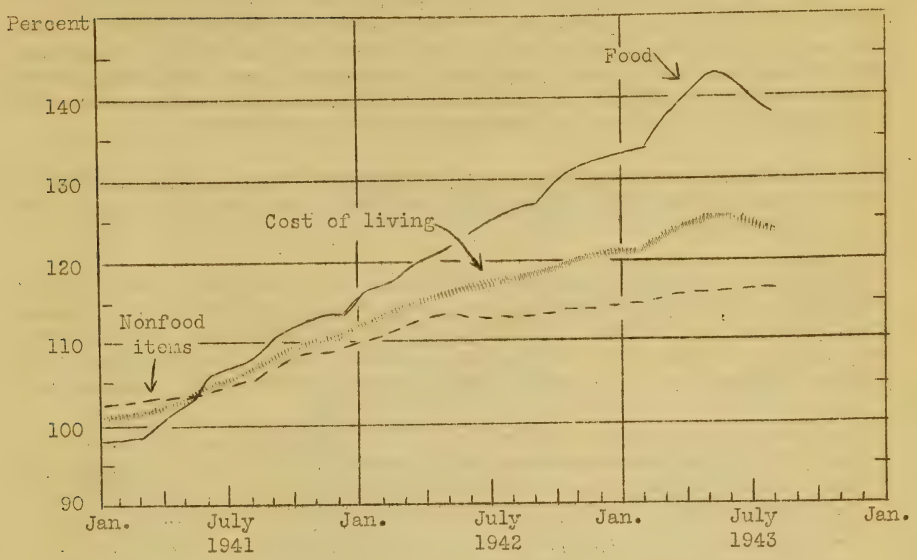
Year	Wisconsin				United States			Wisconsin Milk Production As Percentage of U.S.
	Milk Cows on Farms	Milk Production Per Cow	Butterfat Production Per Milk Cow	Total Milk Production on Farms	Milk Cows on Farms	Milk Production Per Cow	Total Milk Production on Farms	
	Thousands	Pounds		Million Lb.	Thousands	Pounds	Million Lb.	Percent
1924	1,918	5,280	193	10,127	21,417	4,167	89,240	11.3
1925	1,942	5,410	197	10,506	21,503	4,218	90,699	11.6
1926	1,933	5,550	203	10,728	21,312	4,379	93,325	11.5
1927	1,899	5,610	205	10,653	21,191	4,491	95,172	11.2
1928	1,850	5,680	207	10,508	21,223	4,516	95,843	11.0
1929	1,890	5,850	214	11,056	21,618	4,579	98,988	11.2
1930	1,973	5,680	207	11,207	22,218	4,508	100,158	11.2
1931	2,037	5,550	203	11,305	23,108	4,459	103,029	11.0
1932	2,074	5,300	193	10,992	24,105	4,307	103,810	10.6
1933	2,111	5,140	188	10,851	25,062	4,180	104,762	10.4
1934	2,090	5,100	189	10,659	25,198	4,033	101,621	10.5
1935	2,030	5,380	196	10,921	24,187	4,184	101,205	10.8
1936	2,060	5,630	205	11,598	23,727	4,316	102,410	11.3
1937	2,065	5,510	201	11,378	23,340	4,366	101,908	11.2
1938	2,081	5,700	208	11,862	23,215	4,558	105,807	11.2
1939	2,108	5,680	207	11,973	23,273	4,589	106,792	11.2
1940	2,165	5,850	214	12,665	23,684	4,624	109,510	11.6
1941	2,230	6,110	223	13,625	24,357	4,742	115,498	11.8
1942	2,319	6,140	224	14,239	25,159	4,739	119,240	11.9
1943	2,389*	6,000*	219*	14,334*	25,669*	4,619*	118,565*	12.0*

* Preliminary - Based upon BAE estimates as of July 1, 1943.

Reference: Wis. Dept. of Agriculture and BAE of USDA

RETAIL PRICES: TOTAL COST OF LIVING, FOOD AND NONFOOD ITEMS, 1941-43

Index Numbers (1935-39=100)



Data from Bureau of Labor Statistics

Retail prices of all foods combined rose sharply from January, 1942 to June, 1943, and then declined. Prices of other cost-of-living items have risen more gradually, especially since the General Maximum Price Regulation became effective, May 18, 1942. The recent decline in both food prices and cost of living is due in part to the rollback on maximum prices of meats, butter, and certain fresh vegetables.

FARM REAL ESTATE VALUES

It is extremely important that we recognize the present trend toward inflated land prices and view the present trend in the light of past history and experience. The question might be asked, what will happen in the future if the present land price rise is allowed to continue? Judging from past experiences, it appears that we must be extremely careful that our borrowers do not pay prices for land which are out of line with long time values for the type of land being purchased. Each unit being purchased must be considered on the basis of its long time value and earning capacity, if the real estate investment is to prove sound.

The following actual sample case will illustrate what can happen even where a considerable down payment is made and a long term mortgage covers the unpaid balance:

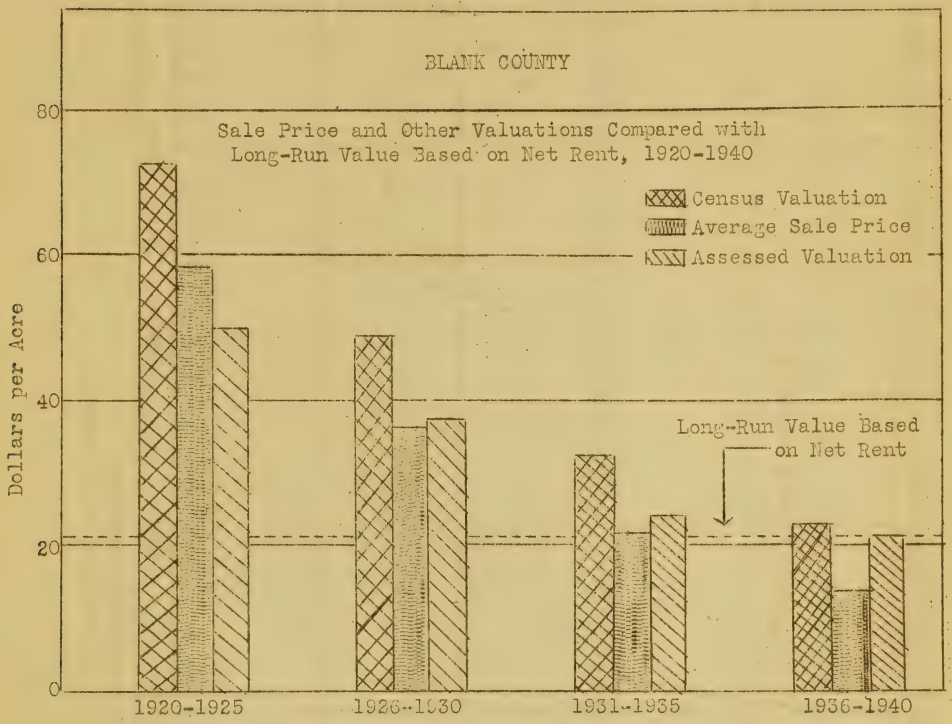
The average sale price of Blank County land in 1920-25 was $59.25 per acre. During 1931-35, only ten years later, the average sale price was $20.93. The following sample case is submitted to illustrate one of the serious consequences of too much fluctuation in land prices. The existence of a 36-year mortgage on which equal annual payments were made, is assumed:

1.	160 acres bought in 1920-25 at $59.25 per acre.....	$9,480.00
2.	Cash payment.....	4,480.00
3.	Balance due.....	5,000.00
4.	Payments on principal for 10 years at $138.89 per year	1,388.90
5.	Balance due, 1931-35.....	3,611.10
6.	160 acres at 1931-35 average sale price, $20.93.....	3,348.80
7.	Debt over sales value in 1931-35.....	262.30
8.	Total amount paid on principal by 1931-35.....	$5,868.90

In this sample case, the farmer had paid a total of $5,868.90 (cash payment of $4,480 plus $1,388.90) by 1931-35, and still owed $262.30 more than the current market value $3,348.80) of his farm in this period, ten years after he had made his purchase. Cases of this kind can be found in many other counties included in this study.

Many people are purchasing farms at the present time at prices which they know are above actual value. In the majority of these cases, the purchaser reasons that the price is justified in the light of high prices received for commodities sold. This type of reasoning does not appear to be justified on the basis of past experience. Most people are inclined to be over optimistic when undertaking a business of their own, and usually overlook some of the facts. It is for this reason that we should be prepared to indicate sound facts which may help borrowers avoid making a mistake which means the difference between success and failure.

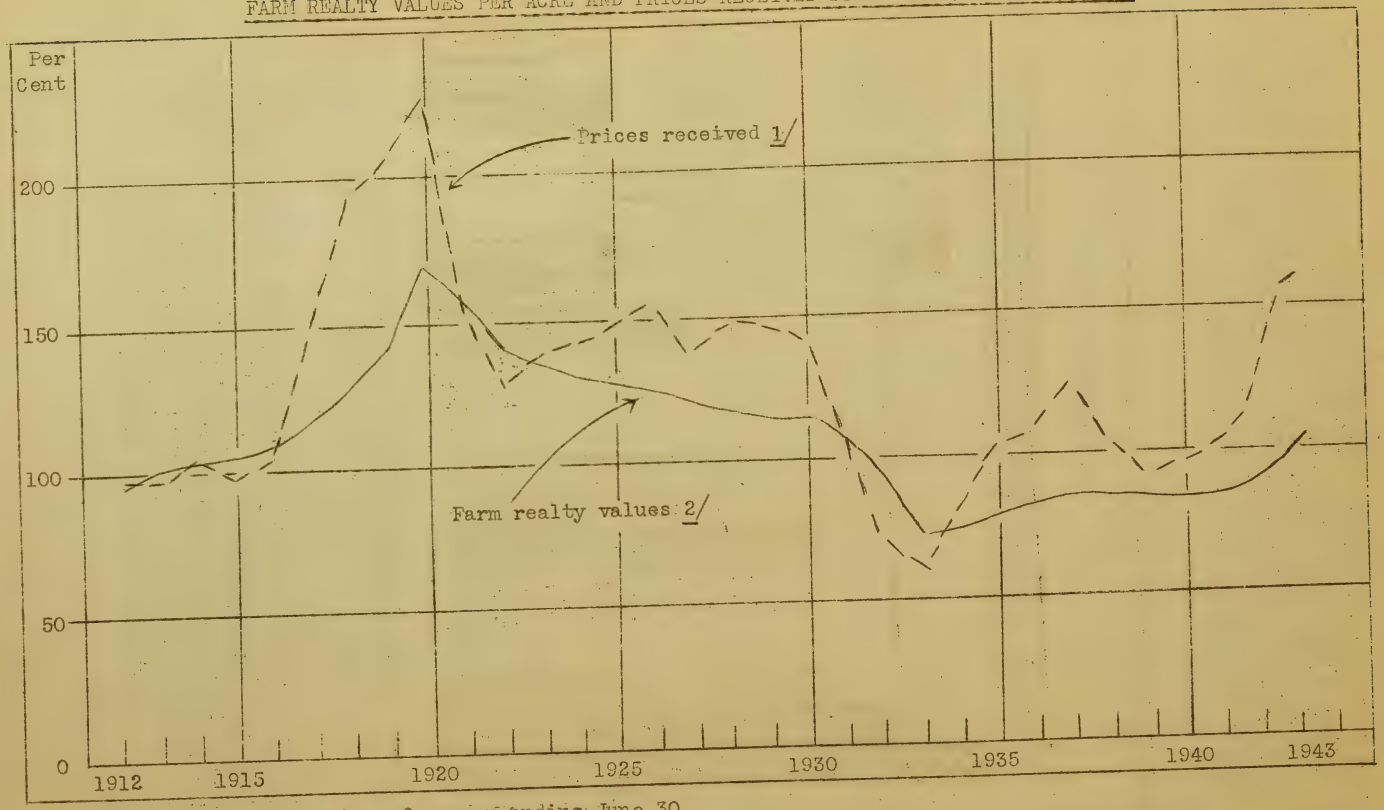
The chart below shows the fluctuation in average sale price of farms in a given county as compared with the census valuation and assessed valuation over given definite periods. The chart indicates that the 1931-1935 sale price of land is about in line with the long run value based on net rent. The net rent level used is a long time figure based on farm rental earnings or the equivalent of the farms long time earning capacity.



Land Prices in Blank County Dropped More Than 50 Percent in Ten Years
(1920-25 to 1931-35)

The graph on page 8 covers the prices received by farmers for commodities sold as well as farm realty values from 1912 through 1943 on a percentage basis. You will note that real estate values in general lag somewhat behind prices received for commodities. In other words, a period of high incomes tends to pull up realty values. At the present time, we are having a very rapid upturn in both prices received and real estate values which indicates caution is necessary in contemplated purchases.

FARM REALTY VALUES PER ACRE AND PRICES RECEIVED BY FARMERS, UNITED STATES



1/ 1910-1914=100, Farm prices for year ending June 30
2/ 1912-1914=100, All farm land and improvements as of March 1
1943 - Preliminary Estimate

The average value per acre of farm real estate for the three states in this region is given in table "A" below on a percentage basis for the years 1912 through 1943. The 1912-1914 period was used as a base of 100%. Table "B" gives the average per acre value in dollars of farm real estate.

Table A. Index Numbers of Value Per Acre of Farm Real Estate by States, Region II, 1912-43 (U.S.D.A., BAE)*

Year	Michigan (Percent)	Minnesota (Percent)	Wisconsin (Percent)
1912	98	95	97
1913	99	100	100
1914	103	105	103
1915	105	107	104
1916	111	122	117
1917	120	138	124
1918	134	155	133
1919	137	167	143
1920	154	213	171
1921	152	212	168
1922	148	187	154
1923	145	177	147
1924	138	170	139
1925	133	159	130
1926	129	155	125
1927	127	145	122
1928	125	140	120
1929	124	138	119
1930	121	133	117
1931	115	116	104
1932	97	93	91
1933	80	79	80
1934	82	83	80
1935	83	83	82
1936	84	85	84
1937	91	87	89
1938	92	88	88
1939	92	86	86
1940	91	86	84
1941	93	86	82
1942	105	90	88
1943	115	100	92

Table B. Average Values Per Acre of Farm Real Estate by States, Region II, by Census Periods 1910-40 (Federal Census) (1943 Estimated)

	1910 (Dollars)	1920 (Dollars)	1930 (Dollars)	1935 (Dollars)	1940 (Dollars)	1943 (Dollars)
Michigan	48	75	68	45	51	63
Minnesota	46	109	69	42	44	50
Wisconsin	57	99	79	53	52	56

*The above figures are useful for showing broad trends and averages for states. They do not necessarily indicate the situation in particular local areas.

SECTION XII - MISCELLANEOUS

HOW TO MEASURE GRAIN, POTATOES AND HAY

A. To find the number of bushels of grain or shelled corn in a bin:

1. Rectangular bin: Multiply the length x width x depth (all in feet) to obtain cubic feet, which is multiplied by .8 to find bushels.

2. Cylindrical bin: Multiply 3.1416 x radius squared x height of bin (all in feet) to obtain cubic feet, which is multiplied by .8 to find bushels.

B. To find the number of bushels of ear corn in a crib:

1. Rectangular crib: Compute cubic feet as for grain in a bin and multiply by .4 to find bushels.

2. Round crib: Compute cubic feet as for grain in a cylindrical bin and multiply by .4 to find bushels, or multiply the distance around the crib by diameter by height (all in feet) and divide by 10.

C. To find the number of bushels of potatoes in a bin:

1. Rectangular bin: Compute cubic feet as for grain and ear corn and multiply by .6 to find bushels.

D. To find the number of tons of hay in a mow:

1. Multiply length by the width by the height (all in feet) and divide by 400 to 525, depending on the kind of hay and how long it has been in the mow. Well settled alfalfa will usually run about 400 cubic feet per ton; clover and timothy mixture, 450 cubic feet per ton.

E. To find the number of tons of hay in a stack:

1. Multiply the overthrow (the distance from the ground on one side over the top of the stack to the ground on the other side) by the length by the width (all in feet). Multiply the result by 3, divide by 10 and then divide by 400 to 525, depending on the kind of hay and how long it has been in the stack.

NUMBER OF PLANTS TO AN ACRE

Distance Apart	No. of Plants	Distance Apart	No. of Plants	Distance Apart	No. of Plants
3 x 3 In.	696,960	4 x 4 Ft.	2,722	13 x 13 Ft.	257
4 x 4 "	392,040	4½ x 4½ "	2,151	14 x 14 "	222
6 x 6 "	174,240	5 x 1 "	8,712	15 x 15 "	193
9 x 9 "	77,440	5 x 2 "	4,345	16 x 16 "	170
1 x 1 Ft.	43,560	5 x 3 "	2,904	16½ x 16½ "	160
1½ x 1½ "	19,360	5 x 4 "	2,178	17 x 17 "	150
2 x 1 "	21,780	5 x 5 "	1,742	18 x 18 "	134
2 x 2 "	10,890	5½ x 5½ "	1,417	19 x 19 "	120
2½ x 2½ "	6,960	6 x 6 "	1,210	20 x 20 "	108
3 x 1 "	14,520	6½ x 6½ "	1,031	25 x 25 "	69
3 x 2 "	7,260	7 x 7 "	881	30 x 30 "	48
3 x 3 "	4,840	8 x 8 "	680	33 x 33 "	40
3½ x 3½ "	3,555	9 x 9 "	537	40 x 40 "	27
4 x 1 "	10,890	10 x 10 "	435	50 x 50 "	17
4 x 2 "	5,445	11 x 11 "	360	60 x 60 "	12
4 x 3 "	3,630	12 x 12 "	320	66 x 66 "	9

RATE OF SEEDING AND WEIGHT PER BUSHEL OF FARM CROPS

Crop	Rate of Seeding per Acre	Weight per Bushel
Alfalfa	10-12 lbs.	60 lbs.
Barley	7-10 pecks	48 lbs.
Beans (field)	2- 5 pecks	60 lbs.
Beets	.....	60 lbs.
Buckwheat	3- 5 pecks	50 lbs.
Carrots	.....	50 lbs.
Clover, red	8-10 lbs.	60 lbs.
Clover, alsike	4- 6 lbs.	60 lbs.
Clover, white in mixtures	2- 5 lbs.	60 lbs.
Clover, mammoth	8-10 lbs.	60 lbs.
Clover, sweet	10 lbs.	60 lbs.
Corn, shelled	6-10 lbs.	56 lbs.
Corn, on cob	.....	70 lbs.
Cucumbers	.....	48 lbs.
Grass, blue	15-20 lbs.	14-32 lbs.
Grass, orchard	15-25 lbs.	14-24 lbs.
Grass, red top	10-15 lbs.	14-40 lbs.
Grass, timothy	4-10 lbs.	45 lbs.
Lespedeza (Japan Clover)	20-25 lbs.	25 lbs.
Millet, for hay	40-50 lbs.	50 lbs.
Millet, for seed	20-25 lbs.	50 lbs.
Milo	5 lbs.	50-60 lbs.
Oats	8-10 pecks	32 lbs.
Onion seed	5- 6 lbs.	56 lbs.
Parsnips	.....	50 lbs.
Peas, alone	8-12 pecks	60 lbs.
Peas and Oats	6 pecks of each	.....
Potatoes	10-15 bu.	60 lbs.
Rape, solid	5- 8 lbs.	60 lbs.
Rye	6- 8 pecks	56 lbs.
Sorghum	8-15 lbs.	50 lbs.
Soy beans, drilled solid	6- 8 pecks	60 lbs.
Soy beans, in rows	2- 3 pecks	60 lbs.
Soy beans, with corn	½ peck	60 lbs.
Sudan Grass (drills)	15-30 lbs.	.....
Sugar beets	6- 8 lbs.	.....
Tomatoes	.....	56 lbs.
Turnips	.....	55 lbs.
Vetch, hairy, with grain	10-20 lbs.	60 lbs.
Wheat, winter	6- 8 pecks	60 lbs.
Wheat, spring	6 pecks	60 lbs.

SILAGE TABLE GIVING CAPACITY OF SILOS

Depth of Silage	Weight of Settled Silage					
	10-ft. diameter	12-ft. diameter	14-ft. diameter	16-ft. diameter	18-ft. diameter	20-ft. diameter
Feet	Tons	Tons	Tons	Tons	Tons	Tons
1	1.26	1.81	2.46	3.22	4.07	5.03
2	2.54	3.66	4.98	6.51	8.23	10.17
3	3.85	5.54	7.55	9.86	12.46	15.40
4	5.19	7.48	10.19	13.31	16.81	20.79
5	6.55	9.45	12.85	16.78	21.21	26.22
6	7.94	11.44	15.56	20.32	25.68	31.75
7	9.37	13.50	18.37	23.99	30.31	37.48
8	10.80	15.56	21.19	27.66	34.95	43.21
9	12.26	17.66	24.04	31.39	39.66	49.03
10	13.74	19.79	26.95	35.18	44.45	54.95
11	15.25	21.95	29.89	39.02	49.31	60.96
12	16.77	24.15	32.89	42.93	54.25	67.07
13	18.32	26.38	35.93	46.90	59.27	73.27
14	19.90	28.65	39.02	50.93	64.36	79.57
15	21.44	30.88	42.04	54.87	69.34	85.72
16	23.05	33.21	45.21	59.01	74.57	92.19
17	24.63	35.47	48.30	63.04	79.67	98.49
18	26.22	37.76	51.42	67.11	84.81	104.84
19	27.83	40.07	54.56	71.22	90.00	111.27
20	29.45	42.41	57.75	75.38	95.25	117.75
21	31.00	44.65	60.79	79.35	100.28	123.97
22	32.65	47.02	64.03	83.58	105.61	130.56
23	34.32	49.41	67.29	87.84	110.50	137.22
24	35.90	51.70	70.40	91.90	116.13	143.56
25	37.60	54.15	73.72	96.23	121.60	150.33
26	39.20	56.46	76.87	100.34	126.80	156.75
27	40.92	58.94	80.24	104.74	132.36	163.63
28	42.55	61.28	83.43	108.90	137.62	170.13
29	44.30	63.79	86.86	113.37	143.27	177.11
30	45.94	66.08	90.09	117.59	148.59	183.69
31	47.63	68.51	93.40	121.90	154.06	189.94
32	49.32	70.94	96.71	126.21	159.53	196.19
33	51.01	73.37	100.02	130.52	165.00	202.44
34	52.70	75.80	103.33	134.83	170.47	208.69
35	54.39	78.23	106.64	139.14	175.94	214.94
36	56.08	80.66	109.95	143.45	181.41	221.19
37	57.77	83.09	113.26	147.76	186.88	227.44
38	59.46	85.52	116.57	152.07	192.35	233.69
39	61.15	87.95	119.88	156.38	197.82	239.94
40	62.84	90.38	123.19	160.69	203.29	246.19

In case of trench silos, it may be roughly estimated that 35 cu. ft. make one ton.

THE VALUE OF A SILO

1. The silo gives from 25 to 30% more feeding value to the corn crop than when it is fed as dry fodder.

2. The silo provides the best and cheapest form of succulent winter feed, which helps to keep the cows healthy and productive when dairy prices are highest.

3. The silo is the cheapest farm building one can erect. It will house more feed nutrients per cubic foot of space than any other farm building.

4. It increases the livestock carrying capacity of the farm at least 25%, and the producing capacity of the farm is increased at least 10%.

5. The silo prevents waste of cornstalks, leaves and husks which contain about 40% of the feeding value of the corn plant.

6. The silo enables the farmer to feed his stock from less acres thereby leaving more crops to be marketed and more profit to himself.

7. Good silage, properly fed, does not injure in the slightest the quality of the milk, butter or cheese.

8. It requires less labor to feed silage and the cattle waste very little of it.

9. The tall silo of small diameter is to be preferred to the one of less height and greater diameter.

WATER REQUIREMENTS OF ANIMALS

Horse.....	7 to 10 gallons daily,	average about 8½
Cow.....	6 to 10 gallons daily,	average about 8½
Hog.....	2 to 3 gallons daily,	average about 2½
Sheep.....	1 to 2 gallons daily,	average about 1½
Person.....	25 to 50 gallons per day, including that used for dishwashing, bathing, etc.	

USEFUL INFORMATION FOR FARM BUILDING

1. Board Measure: The unit of measure is the board feet, which is a board one inch thick and one foot square. Lumber is always sold on the basis of 1,000 feet board measure. (B.M.) Formula: To find B.M. multiply length in feet by width and thickness in inches, and divide the product by 12.

2. One thousand shingles, laid four inch to the weather, will cover one hundred square feet of surface and five lbs. of shingle nails will fasten them on.

3. One-fifth more siding and flooring is needed than the number of square feet of surface to be covered, because of the lap in siding and flooring. Narrow siding will require one-fourth more.

4. One thousand laths will cover seventy yards of surface and eleven pounds of lath nails will nail them on.

5. Eight bushels of good lime, sixteen bushels of sand and one bushel of hair will make enough good mortar to plaster 100 square yards.

6. One cord of stone, three bushels of lime and a cubic yard of sand will lay one hundred cubic feet of wall.

7. Cement one bushel, and sand two bushels, will cover 3½ square yards, one inch thick; 4½ square yards 3/4 inch thick, and 6-3/4 square yards 1/2 inch thick.

   One bushel of cement and one bushel of sand will cover 2-1/4 square yards one inch thick; 3 square yards 3/4 inch thick, and 4½ square yards 1/2 inch thick.

8. Amount of paint required: The following is an approximate rule:

   Divide the number of square feet of surface by 200. The result will be the number of gallons of liquid paint required to give two coats; or divide by 18 and the result will be the number of pounds of pure ground white lead required to give three coats.

TANK CAPACITIES

1. Square: To find the number of gallons in any square or oblong tank, multiply number of cubic feet it contains by 7.4805.

2. Circular: To find the contents in gallons of circular tanks, square the diameter in feet, multiply by the depth, and then multiply by 5.875.

HOW TO MAKE QUALITY CONCRETE

1. Water: Mixing water should be clean enough to drink.

2. Sand and Gravel: Sand should be clean, hard and well graded, that is, with particles of many different sizes from very fine up to those which will pass through a No. 4 screen (4 openings per linear inch). Gravel should be clean, hard and range in size from 1/4 inch up to 1½ in. Crushed stone is sometimes used as gravel and should be similarly graded.

   Bank-run gravel is often suitable for concrete if tested to make sure that it is clean enough, then screened into separate lots of sand and gravel. It is not wise to use the natural mixture of bank-run gravel without testing for silt and screening into proper sizes.

3. Cement: Cement should be kept in a dry place. Any cement containing lumps so hard that they do not readily pulverize when struck lightly with a shovel should not be used.

4. Mixing and Placing Concrete: Good concrete is made by carefully measuring all materials -- water, cement, sand and gravel. Satisfactory trial mixes are shown in the table below:

Suggested Concrete Mixes

Use of Concrete	Type of Concrete	U.S.Gal. of Water per Sack Cement, Av. Moist Sand	Sand & Gravel per Sack Cement		Largest Size of Gravel, Inches
			Sand Cu.Ft.	Gravel Cu.Ft.	
Floors (barn & milk house, manure pit & barnyard pavement.)	A	5	2-1/4	3	1-1/2
Foundations & footings	B	5-1/2	2-3/4	4	1-1/2
Milk cooling tank	C	5	2-1/4	2-1/2	3/4

These are trial mixes for average conditions. It may be necessary to change proportions of sand or gravel slightly to get the most workable mix for a particular job. Do not increase the amount of water per sack of cement. If sand is wet, decrease the amount of water 1/2 gal. per sack of cement.

For machine mixing allow 1 to 2 minutes mixing after all materials are in the mixer. Freshly mixed concrete should be placed in forms immediately, then thoroughly tamped and spaded to assure smooth surfaces and dense concrete.

5. Curing Concrete: Concrete needs moisture to harden properly. New concrete should, therefore, be protected from drying out for 7 days. Floors and other horizontal surfaces should be kept covered with moist earth, straw, canvas, etc., and this material kept wet for the required time. Walls should be protected with coverings which are kept wet.

6. How to Estimate Concrete Materials: The table below shows the amounts of materials required per sq. ft. of different kinds of concrete. For example, in building a 5-inch thick floor, 20 x 30 ft., proceed as follows: Table below shows that 100 sq. ft. of 5-inch floor requires:

9.2 sacks of cement
.9 cu. yd. of sand
1.2 cu. yd. of gravel

Then for 600 sq. ft., as in this example, materials needed are found by multiplying these quantities by 6:

9.2 x 6 = 55.2 sacks of cement
.9 x 6 = 5.4 cu. yd. of sand
1.2 x 6 = 7.2 cu. yd. of gravel

On small jobs increase quantities about 10 per cent to allow for variables and waste.

Materials Required Per 100 Sq. Ft. of Concrete

Use of Concrete	Thickness of Concrete	Sacks of Cement	Sand Cu.Ft.	Gravel Cu.Yd.
Floors 1:2-1/4:3 mix	5 in.	9.2	.9	1.2
Foundations and footings 1:2-3/4:4 mix	8 in.	12.3	1.4	1.9

Amount of Materials Required Per Cubic Yard of Concrete

Type of Concrete	Sacks of Cement	Sand Cu. Yd.	Gravel Cu. Yd.	Largest Size of Gravel
A	6-1/4	2/3	3/4	1-1/2 in.
B	5	2/3	3/4	1-1/2 in.
C	6-1/2	2/3	3/4	3/4 in.

HOW TO FIGURE QUANTITIES

Quantities of Cement, sand & Gravel Required to Make 1 Cu. Yd. of Compact Mortar or Concrete

Mixtures			Quantities of Materials				
Cement	Sand	Gravel	Cement in Sacks	Sand		Gravel	
				Cu.Ft.	Cu.Ft.	Cu.Ft.	Cu.Ft.
1	2	-	12	24	0.9	-	-
1	3	-	9	27	1.0	-	-
1	1	1-3/4	10	10	0.37	17	0.63
1	1-3/4	2	8	14	0.52	16	0.59
1	2-1/4	3	6-1/4	14	0.52	19	0.70
1	2-3/4	4	5	14	0.52	20	0.74

(1 sack cement equals 1 cu. ft.; 4 sacks equal 1 Bbl.)

Mortar Materials Required for Concrete Masonry (8-in. Wall)

For Ordinary Work:

One sack cement, 1 cu. ft. lime, and 6 cu. ft. sand will mortar sufficient to lay up the following:

150 - 8 x 8 x 16 inch block, or
200 - 5 x 8 x 12 inch concrete building tile

For Special Work:

One sack cement, 10 pounds of lime and 3 cu. ft. sand will make mortar sufficient to lay up the following:

75 - 8 x 8 x 16 inch block, or
100 - 5 x 8 x 12 inch concrete building tile

MATERIALS REQUIRED FOR 100 SQ. FT. OF SURFACE FOR VARYING THICKNESSES OF CONCRETE

Thickness of Mortar or Concrete (Inches)	Amount of Mortar or Concrete (Cu. Yd.)	Proportions								
		1 : 2			1 : 3			1 : 1 : 1-3/4		
		Cement (Sacks)	Sand (Cu.Ft.)	Gravel (Cu.Ft.)	Cement (Sacks)	Sand (Cu.Ft.)	Gravel (Cu.Ft.)	Cement (Sacks	Sand (Cu.Ft.)	Gravel (Cu.Ft.)
3/8	0.115	1.4	2.8	-	1.0	3.0	-	-	-	-
1/2	0.15	1.8	3.6	-	1.3	4.0	-	-	-	-
3/4	0.23	2.7	5.4	-	2.0	6.0	-	2.3	2.3	3.9
1	0.31	3.7	7.4	-	2.7	8.1	-	3.1	3.1	5.3
1-1/4	0.38	4.5	9.0	-	3.3	10.0	-	3.8	3.8	6.5
1-1/2	0.45	5.4	10.8	-	4.0	12.0	-	4.6	4.6	7.8
1-3/4	0.54	6.4	12.8	-	4.7	14.1	-	5.4	5.4	9.2
2	0.62	7.3	14.6	-	5.4	16.2	-	6.2	6.2	10.5
		1 : 1-3/4 : 2			1 : 2-1/4 : 3			1 : 2-3/4 : 4		
3	0.92	7.5	12.9	14.7	5.8	12.9	17.5	4.6	12.9	18.4
4	1.24	10.0	17.3	19.9	7.8	17.3	23.6	6.2	17.3	24.8
5	1.56	-	-	-	9.2	21.7	29.6	7.8	21.8	31.2
6	1.85	-	-	-	11.5	26.0	35.2	9.3	26.0	37.0
8	2.46	-	-	-	15.4	34.4	46.8	12.3	34.4	49.3
10	3.08	-	-	-	19.3	43.2	58.5	15.4	43.2	61.6
12	3.70	-	-	-	23.1	51.8	70.4	18.5	51.8	74.0

SQUARE FEET BARN SPACE NEEDED PER ANIMAL

Horse	90	Square Feet
Dairy Cow	75	" "
Beef Cow	60	" "
Steer	50	" "
Young Cattle	30-40	" "
Calf	20-25	" "
Bull	150	" "
Ewe	16	" "
Lamb (feeder)	12	" "
Sow	50	" "
Pig (feeder)	15	" "
Hen (light)	3½	" "
Hen (heavy)	4	" "

Farm Management Dept., M.S.C.

DIMENSIONS OF COW STALLS

Breed	Approximate Weight - Lb.	Length of Stall	Width of Stall
Ayrshire	1,000	4 ft. 8 in.	3 ft. 6 in.
Brown Swiss	1,200	5 ft. 0 in.	3 ft. 8 in.
Guernsey	1,000	4 ft. 8 in.	3 ft. 6 in.
Holstein	1,200	5 ft. 0 in.	3 ft. 8 in.
Jersey	900	4 ft. 6 in.	3 ft. 5 in.
Shorthorn	1,400	5 ft. 4 in.	4 ft. 0 in.

(These are dimensions commonly employed for average size cows. Stall lengths for large cows may be increased 3 inches; for small cows decreased 3 inches. Stall length is measured from edge of gutter to center of curb. Heifers require stalls about 3 ft. 0 in. wide, 4 ft. 0 in. long.)

GESTATION TABLE

Average Gestation Period	Weeks	or Days	Extremes (days)
Sow	16	112	109 to 120
Ewe	22	150	146 to 157
Cow	40½	283	240 to 311
Mare	48½	340	307 to 412

Date of Service	Date Animal Due to Give Birth			
	Mare	Cow	Ewe	Sow
Jan. 1	Dec. 7	Oct. 11	May 31	Apr. 25
Jan. 11	Dec. 17	Oct. 21	June 10	May 5
Jan. 21	Dec. 27	Oct. 31	June 20	May 15
Jan. 31	Jan. 6	Nov. 10	June 30	May 25
Feb. 10	Jan. 16	Nov. 20	July 10	June 4
Feb. 20	Jan. 26	Nov. 30	July 20	June 14
Mar. 2	Feb. 5	Dec. 10	July 30	June 24
Mar. 12	Feb. 15	Dec. 20	Aug. 9	July 4
Mar. 22	Feb. 25	Dec. 30	Aug. 19	July 14
Apr. 1	Mar. 7	Jan. 9	Aug. 29	July 24
Apr. 11	Mar. 17	Jan. 19	Sept. 8	Aug. 3
Apr. 21	Mar. 27	Jan. 29	Sept. 18	Aug. 13
May 1	Apr. 6	Feb. 8	Sept. 28	Aug. 23
May 11	Apr. 16	Feb. 18	Oct. 8	Sept. 2
May 21	Apr. 26	Feb. 28	Oct. 18	Sept. 12
May 31	May 6	Mar. 10	Oct. 28	Sept. 22
June 10	May 16	Mar. 20	Nov. 7	Oct. 2
June 20	May 26	Mar. 30	Nov. 17	Oct. 12
June 30	June 5	Apr. 9	Nov. 27	Oct. 22
July 10	June 15	Apr. 19	Dec. 7	Nov. 1
July 20	June 25	Apr. 29	Dec. 17	Nov. 11
July 30	July 5	May 9	Dec. 27	Nov. 21
Aug. 9	July 15	May 19	Jan. 6	Dec. 1
Aug. 19	July 25	May 29	Jan. 16	Dec. 11
Aug. 29	Aug. 4	June 8	Jan. 26	Dec. 21
Sept. 8	Aug. 14	June 18	Feb. 5	Dec. 31
Sept. 18	Aug. 24	June 28	Feb. 15	Jan. 10
Sept. 28	Sept. 3	July 8	Feb. 25	Jan. 20
Oct. 8	Sept. 13	July 18	Mar. 7	Jan. 30
Oct. 18	Sept. 23	July 28	Mar. 17	Feb. 9
Oct. 28	Oct. 3	Aug. 7	Mar. 27	Feb. 19
Nov. 7	Oct. 13	Aug. 17	Apr. 6	Mar. 1
Nov. 17	Oct. 23	Aug. 27	Apr. 16	Mar. 11
Nov. 27	Nov. 2	Sept. 6	Apr. 26	Mar. 21
Dec. 7	Nov. 12	Sept. 16	May 6	Mar. 31
Dec. 17	Nov. 22	Sept. 26	May 16	Apr. 10
Dec. 27	Dec. 2	Oct. 6	May 26	Apr. 20

Duration and frequency of heat in farm animals in regular condition:

	In heat for	If not impregnated heat will recur in
Mares	5-7 days*	3 to 6 weeks
Cows	2-3 days*	3 to 4 weeks
Ewes	2-3 days	17 to 28 days
Sows	2-4 days	21 days

* Subject to variation

ESTIMATING THE WEIGHTS OF DAIRY COWS FROM HEART-GIRTH MEASUREMENTS

By using any accurate tape-measure and this table it is possible to estimate with considerable accuracy the weights of individual dairy cows. The measuring tape should be placed around the animal directly back of the front legs. The animal should be standing squarely on all four legs. A cow with a heart-girth measurement of 69 inches should have, according to the following table, an actual weight of approximately 947 pounds and a cow with a heart-girth measurement of 75 inches, an actual weight of approximately 1,197 pounds.

Heart-girth	Weight	Heart-girth	Weight	Heart-girth	Weight	Heart-girth	Weight
In.	Lbs.	In.	Lbs.	In.	Lbs.	In.	Lbs.
26	80	42½	248	59½	622	76½	1,263
26½	82	43	257	60	637	77	1,285
27	84	43½	266	60½	652	77½	1,308
27½	86	44	275	61	668	78	1,331
28	89	44½	284	61½	684	78½	1,354
28½	92	45	294	62	700	79	1,377
29	95	45½	304	62½	716	79½	1,400
29½	98	46	314	63	732	80	1,423
30	101	46½	324	63½	749	80½	1,446
30½	104	47	334	64	766	81	1,469
31	108	47½	344	64½	783	81½	1,492
31½	113	48	354	65	800	82	1,515
32	118	48½	364	65½	817	82½	1,538
32½	123	49	374	66	835	83	1,561
33	128	49½	384	66½	853	83½	1,584
33½	133	50	394	67	871	84	1,607
34	138	50½	404	67½	889	84½	1,630
34½	143	51	414	68	908	85	1,653
35	148	51½	424	68½	927	85½	1,676
35½	153	52	434	69	947	86	1,699
36	158	52½	445	69½	967	86½	1,722
36½	163	53	456	70	987	87	1,745
37	168	53½	467	70½	1,007	87½	1,768
37½	174	54	478	71	1,027	88	1,791
38	180	54½	489	71½	1,048	88½	1,814
38½	186	55	501	72	1,069	89	1,837
39	192	55½	513	72½	1,090	89½	1,860
39½	200	56	526	73	1,111	90	1,883
40	208	56½	539	73½	1,132	90½	1,906
40½	216	57	552	74	1,153	91	1,929
41	224	57½	565	74½	1,175	91½	1,952
41½	232	58	579	75	1,197	92	1,975
42	240	58½	592	75½	1,219	...	.....
...	...	59	607	76	1,241	...	.....

TABLE OF LIVE AND DRESSED WEIGHTS FOR HOGS AND CATTLE

Dressing Percentages

	Per Cent
CATTLE	
Thin cattle (dairy cows)	40-50
Barely warmed steers	50-55
Good conditioned steers	55-60
Prime cattle -- Long fed steers	60 up
Average for cattle	55
HOGS (Chilled Carcass)	
Prime heavy hogs 350-400 lbs.	82-84
Heavy butchers 280-350 lbs.	80-82
Medium butchers 220-280 lbs.	78-80
Light butchers 180-220 lbs.	77-79
Heavy packing 300-350 lbs.	81-83
Medium packing 250-300 lbs.	79-80
Light packing 200-280 lbs.	77-78
Bacon hogs 160-220 lbs.	76-77
Light mixed 150-220 lbs.	75-76
Extra light 125-150 lbs.	74-75
Shipper hogs 100-200 lbs.	72-76
SHEEP	
Wide range	40-65
Average lambs	48-52

Average Dressing 1200 Lb. Steer

		Per Cent
Live weight	1200 lbs.	-----
Carcass	700 lbs.	58.3
Hide	75 lbs.	6.2
Head, feet, knees	45 lbs.	3.7
Oleo fat	80 lbs.	6.6
Liver	12 lbs.	1.0
Heart	3 lbs.	0.25
Lungs	20 lbs.	1.6
Tongue	5 lbs.	0.41
Cheek meat	5 lbs.	0.41
Rough tallow and entrails	84 lbs.	7.0
Liquid blood	46 lbs.	3.8
Paunch and contents	106 lbs.	8.8
Lips and weasand meat	4 lbs.	0.3
Tail, bung, casings	15 lbs.	1.2
		99.57